

Popular Science

★ FOUNDED MONTHLY 1872

Rides both
roads and air
See page 18



\$1,000 IN CASH PRIZES EVERY MONTH

MARCH

See Page 11

25 CENTS

This better hammer *keeps* better

YOU can buy a Plumb Hammer today that will keep new for years.

It will retain its balance, its accuracy, its power — the things that make it famous—for its head will stay tight at a turn of your wrist on the Take-Up Wedge.

Everything you want in a hammer — permanently. Such as a larger face for greater accuracy; a shorter neck for better balance, more power; knife-edge claws

that pull any nail with ease.

This is the hammer that hundreds of carpenters helped to design, the tool whose long life and skillful service make it the right hammer for every man who wants to do good work easily.

The hardware dealer who sells you a Plumb Hammer, or other Plumb Tool, wants to give you — does give you—all the value your money can buy.

FAYETTE R. PLUMB, Inc., Philadelphia, U. S. A.



Instantly, with a turn of the wrist, you retighten the head of any Plumb Tool. V-shape of wedge expands wood of handle against all sides of eye all the way in.



Look for the
Red Handle
with the
Black Head
(Color Combination
registered as
trade mark
in U.S. Patent Office)
EXCLUSIVELY
PLUMB



PLUMB

DOUBLE LIFE

**Hammers Hatchets
Files Sledges Axes**



"Pick the pipe-smoking man every time"

Gilda Gray

The pick of
pipe-smokers
—because it's



Quality created
the demand—
Demand made
possible the price

**NOW
12¢**

Guaranteed by
The American Tobacco Co.
INCORPORATED

Popular Science Monthly

The Magazine of Invention and Discovery

MARCH, 1926; Vol. 108, No. 3
25 cents a Copy; \$2.50 a Year



Published in New York City at
250 Fourth Avenue

Don't Miss These Features

BEGINNING in this issue, **POPULAR SCIENCE MONTHLY** offers \$1,000 in cash prizes each month in a remarkable new Picture Contest in which John and Mary Newlywed return with fascinating problems for you to solve. This contest is open to everybody. Turn to page 11 and read how you may win one of the big cash prizes, and at the same time train your mind to keener observation.

ABOUT this time every year many of us get out our pencil and paper and renew our planning of the new home we have dreamed of. Others of us find equal pleasure in new schemes to improve and beautify our present abodes. This business of



home building is mighty fascinating, but it has its pitfalls. It also has its little "kinks" and "dodges" that save money and trouble. In "Mistakes I Made in Building My House" on page 28 you'll find one of the most interesting and helpful articles on the subject ever printed.

HUNDREDS of readers have written telling us how much they enjoyed trying the mental tests published in last month's issue. Another and equally fascinating set of tests appears

Tom Shervlin, one of the greatest all-round athletes ever produced at Yale. Death ended his career in his 30's. Do athletes die young? See page 34

in this issue on page 26. See how well your mind works. It's a profitable game that anyone can play.

THE number of great athletes whose lives have been snuffed out in recent months has aroused much questioning, especially among those of us who are lovers of sport. Is there danger in much strenuous exercise? Do the stars of football, baseball, boxing, tennis, and rowing burn out before their time? Is the "athletic heart" a hazard to guard against? A remarkable article on page 34 answers these questions.

DID you ever stop to think how many of the comforts and conveniences you enjoy today were born of poverty, heart-breaking discouragement and dogged determination? Read, on page 31, the dramatic story of a great inventor whose courage freed thousands of women from the bonds of drudgery.

And 200 Other Articles and Pictures, including—

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POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, \$2.50; foreign countries, \$3. Entered as second-class matter Dec. 29, 1914, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter applied for at Chicago, Ill. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright 1926, by the Popular Science Publishing Co., Inc. The contents of

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Unfailing radio power from the LIGHT SOCKET

with

Balkite Radio Power Units

Balkite Radio Power Units give unfailing, uniform current for both circuits from the light socket. One very popular Balkite installation, especially for heavy duty sets where reserve "A" power is required is with the Balkite Battery Charger and Balkite "B". Here the noiseless, high-rate Balkite Battery Charger is ideal. If your battery should be low, you merely turn on the charger and operate the set. Balkite "B" eliminates "B" batteries entirely and supplies plate current from the light socket.

Balkite light socket equipment

Another very popular Balkite installation is with the Balkite Trickle Charger and Balkite "B". The Balkite Trickle Charger converts your "A" battery into an automatic "A" power unit that provides "A" current from the light socket, so that both circuits operate from the lighting circuit. This installation enables you to convert your present receiver into a light socket set.

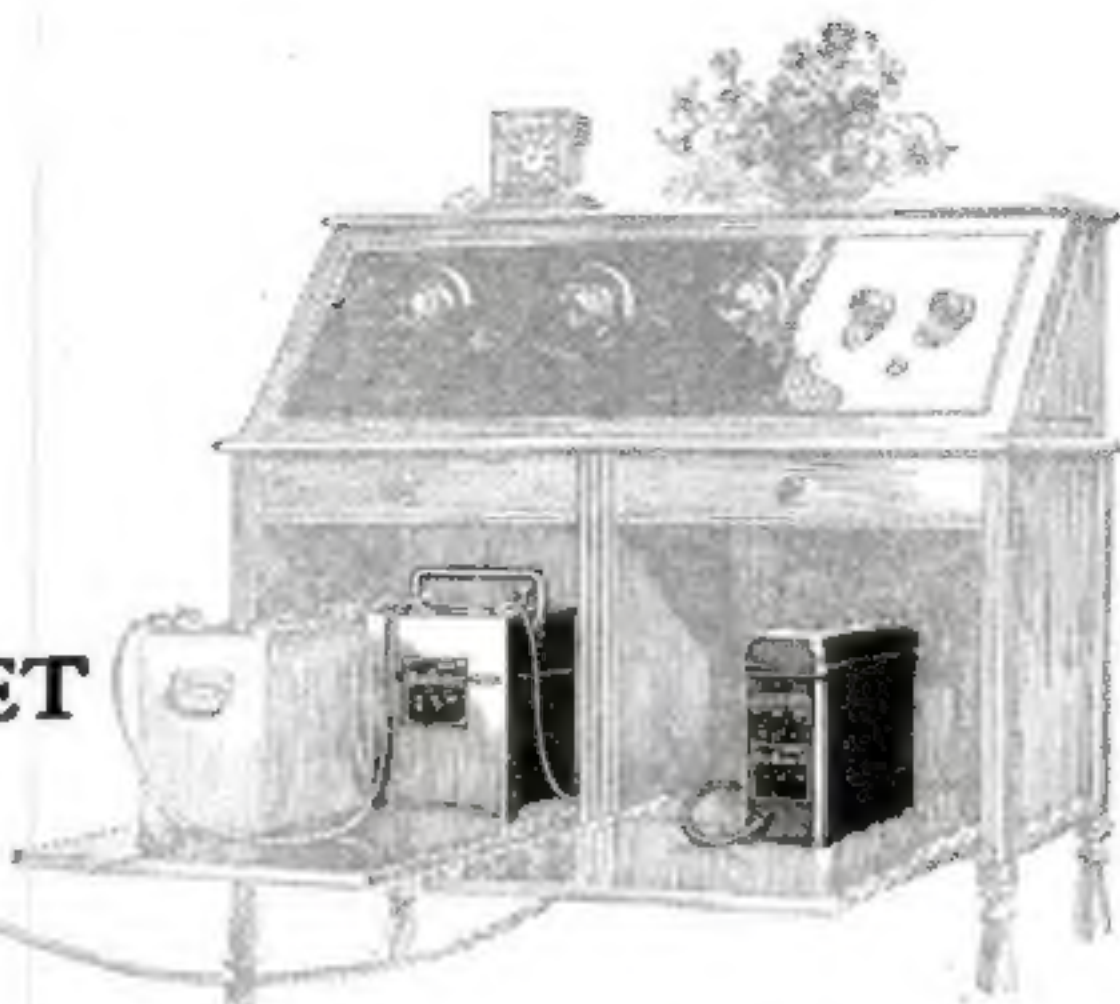
Noiseless—No bulbs—Permanent

All Balkite Radio Power Units are permanent pieces of equipment, entirely noiseless, have no bulbs, nothing to break, replace or get out of order. Their current consumption is very low. All operate from 110-120 volt AC current, with models for 50, 60 and other cycles. All are tested and listed as standard by the Underwriters' Laboratories.

[The Balkite Railway Signal Rectifier is now standard equipment on over 50 leading American and Canadian Railroads]

FANSTEEL
Balkite
Radio Power Units

MANUFACTURED BY FANSTEEL PRODUCTS COMPANY, INC., NORTH CHICAGO, ILLINOIS



Balkite Trickle Charger

Converts any 6-volt "A" battery of 30 ampere hours capacity or more into an automatic "A" power unit that furnishes "A" current from the light socket. With 4-volt and smaller 6-volt batteries may be used either as an intermittent charger or a trickle charger. \$10. West of Rockies, \$10.50. In Canada, \$15.



Balkite Battery Charger

The popular rapid charger for 6-volt "A" batteries. Noiseless. Can be used during operation. Special model for 25-40 cycles, \$19.50. West of Rockies, \$20. In Canada, \$27.50.



Balkite "B"

Eliminates "B" batteries and supplies plate current from the light socket. For sets of 6 tubes and less. \$15. In Canada, \$19.50.

Balkite "B" II

Supplies plate current from the light socket. Will serve any standard set. Especially adapted to sets of 6 tubes or more. \$55. In Canada, \$75.

Decide where you want to go before you start!

YOU wouldn't think of getting on a train without knowing beforehand where you wanted to go. No one in his right mind would start out on a journey with no idea of his destination.

Yet, many a man starts out on life's journey without the ghost of an idea of his goal. He takes the first job that comes along. He drifts around from one sort of work to another. He makes no attempt to find out which trade or profession he is best fitted for, and which offers him the best future.

Every man has a natural talent for one particular vocation, and that is the vocation in which he will achieve the biggest success. Your talent is shown in your "hobby"—in the thing you enjoy doing most, whether it's making speeches or selling goods, tinkering with cars or electric motors, drawing pictures or keeping accounts.

But natural talent alone is not enough. It must be developed, through training.

Instead of leaving his career to accident, the successful man plans it in advance. He prepares for promotion through technical training—either with a good home-study school, residence trade school, or set of books. He gets ready for opportunity *before* it comes. He can step into a bigger job when the chance

comes his way—and it always does come to the man who is trained to accept it.

Decide on Your Future Through "Money-Making Opportunities"

How about your future? Are you looking ahead and planning for brighter times? Or are you merely dissatisfied with your present job, without doing anything about getting a better one? Right here and now you can decide on what you want to be, and how you can attain your ambition.

"Money-Making Opportunities," the new section of **POPULAR SCIENCE MONTHLY** on pages 128F to 158 of this issue, is the meeting-place for men who need training and those

whose business is training men. Grouped on these pages are dozens and dozens of ways to win success. We have made it easy for you to decide on your career by placing all advertisements of courses of training, technical books, etc., in this one convenient section.

It will pay you to turn to "Money-Making Opportunities" now. Read carefully each advertisement. Pick out those which appeal to you most—those in the field

you'd like to enter. Then write to those advertisers for full particulars of their training.

For an hour or so of your time, and a few two-cent stamps, you can get "inside information" about your chosen profession. You can learn what others have done in the line of work you wish to follow. You can find out what your own opportunities are. You can get facts and figures that will enable you to decide quickly and rightly—to take the road best suited to you, and follow it to real success.

This is how thousands won their way to the top. Through the pages of **POPULAR SCIENCE MONTHLY**, men with no experience, with little or no education, with nothing but their own ambition behind them, have risen quickly to positions of responsibility and big incomes. Their opportunity is your opportunity.

Turn now to pages 128F to 158. Study "Money-Making Opportunities," come to a decision, and then act! Your future depends upon it. Make your life's journey a success by deciding where you want to go—NOW!



\$100 in Prizes

for Readers of
"Money-Making
Opportunities."
Full Details of
This Month's
Great Prize Con-
test and Last
Month's Winners
Will Be Found
on Page 128F.

33 Pages of "Money-Making Opportunities"
to Help YOU Decide on Your Future
TURN TO PAGES 128F TO 158 NOW



Your hardware dealer will be glad to show you these two super-tools. Ask to look at them next time you are in.

VANADIUM

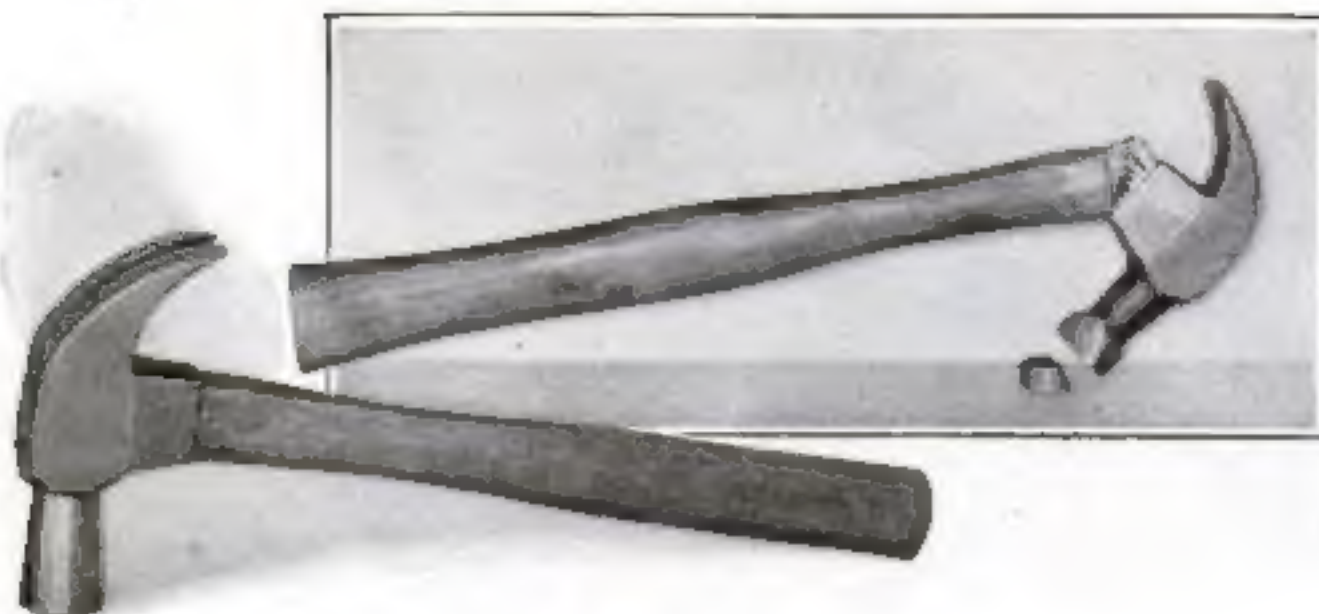
You buyers of good tools—the kind of tools that give husky, long-lived service—can't do any better than to make sure a V & B Vanadium Hammer and a V & B Unbreakable Plane are in your kit. They are made for the craftsman that buys the best. V & B Vanadium Hammers are made from Vanadium steel and handled with the finest white hickory. A Vaughan's Expansion Wedge firmly locks the handle tight. It is positive insurance of a tight head. V & B Unbreakable Planes are drop-forged—not cast. They stand the falls that would break an ordinary plane. They are furnished, too, with all Vanadium steel blades.

VAUGHAN & BUSHNELL MANUFACTURING COMPANY

Makers of Fine Tools

2114 Carroll Ave.

Chicago, Ill. U.S.A.



THREE hammers have both been subjected to the same tests by the Popular Science Institute. What happened is plainly visible. The approved hammer, below, was purchased from a reliable hardware dealer for \$1.60. The other was obtained in a chain store and cost 50 cents

Do You Know How to Select Good Tools?

By HAZEN G. TYLER, M.E., E.E.

Associate Director

Popular Science Institute of Standards

SHOWN two hammers—one costing 50 cents and the other \$1.60—would you be able to tell whether the difference in price was justified? Probably not, if the two hammers did not show more surface indication of their merits and demerits than the two illustrated above did when purchased.

But the tests of the Popular Science Institute of Standards proved, without question, that the \$1.10 difference in price was warranted. The \$1.60 hammer is capable of standing up under hardest usage by a carpenter for a lifetime. The 50-cent hammer is likely to break under the first hard blow.

In the first place, upon examination by a wood expert, it was found that while the handles of both hammers were of hickory, the handle of the \$1.60 hammer was of the best grade of stainless, second-growth white hickory and the 50-cent hammer handle of an inferior grade of hickory in which the grain was not true and which contained knotholes.

It will be noticed that the break in the 50-cent hammer handle is very abrupt, thus indicating the use of heart wood from the center of the tree. The best handle hickory comes from sap wood, which is tenacious and springy. Sap wood is used in the \$1.60 hammer.

A torsion machine was used in making the laboratory test on the handles. The 50-cent hammer was placed in this machine and pressure exerted. The hammer failed under 1123 pounds-inches—the fracture of the handle resulting, as is evident in the picture. But 2325 pounds-inches of pressure did only the slight damage to the \$1.60 hammer.

A second sample of the \$1.60 hammer stood more than 3000 pounds-inches of pressure before a fracture occurred.

The face and wedge test further proved the inferiority of the cheaper hammer.

Both hammers were given 10,000 blows in a striking-machine. The purpose of this test is to see if the face is affected (whether the steel is too soft or too hard) and also to determine whether the head is properly wedged. Just what happened to the two hammers, as the result of this test, is quite evident in the illustration. The face of the 50-cent hammer was broken, and the head became so loose that it might fly off at any moment. The steel in the more expensive hammer was neither too soft nor too brittle, for the face showed no effects from this strenuous test. Also, the head of the \$1.60 hammer remained unloose.

It was noted here that the fibres in the back of the eye of the 50-cent hammer had pulled away from the head of the hammer. This shows less careful design of the interior of the eye and poor wedging. This cheaper hammer contained only two wooden wedges and no steel wedges. There were three steel wedges and one wooden wedge in the \$1.60 hammer, with the result that the handle remained firmly wedged in the head despite the exhaustive tests that were applied.

In the nail-pulling test, it was shown that the \$1.60 hammer was again superior. This test brought out such defects as wire edge and improper cleaning in the claws of the cheaper hammer. It was also evident from this test that the whole head of the 50-cent hammer had evidently been heat-treated in one operation, which meant that all parts of the head were of the same degree of hardness. In a properly-made hammer head, varying degrees of hardness in different parts are essential.

Hardness tests were conducted on the Brinell testing machine and the scleroscope, further proving the fact that the steel in the cheaper hammer was entirely too brittle.

From the results of the tests described above, and from similar results obtained from testing other hand tools, the Popular Science Institute of Standards has come to the very definite conclusion that the only way the individual buyers of tools can be sure of the quality is to buy branded and advertised tools from reliable hardware merchants.

A list of all tools (and radio products) that have satisfactorily withstood laboratory tests can be obtained from the Popular Science Institute of Standards, 250 Fourth Avenue, New York, N. Y.

Send for List of Approved Products

POPULAR SCIENCE Monthly Guarantee

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Science Monthly guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in Popular Science Monthly may expect that these products will give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Science Monthly. **THE PUBLISHERS.**





Model R Receiver:
Rauland-Lyric-
equipped. Price
\$90 (East of the
Rocky Mountains)

Beauty and Permanence

Listeners Marvel—

at the wealth of enjoyment awaiting but a touch of the fingers.

Women Are Delighted—

with the tasteful stateliness of the Model R cabinet, as much as with the neatness of its battery accommodations.

Engineers Voice Approval—

of the rigid spot-welded steel chassis, protecting from damage every part of a set that stands as a notable example of the completely manufactured rather than the merely assembled radio receiver.

Service Men Commend—

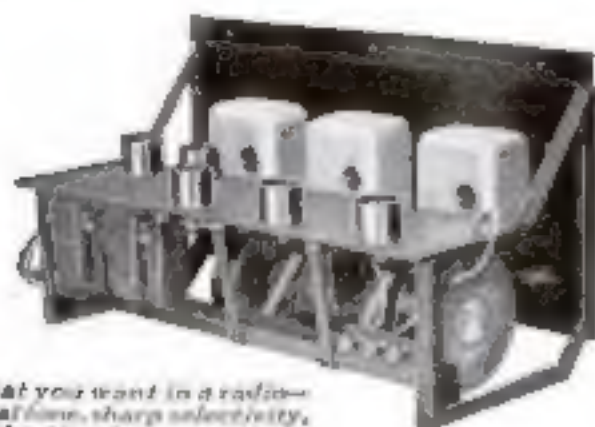
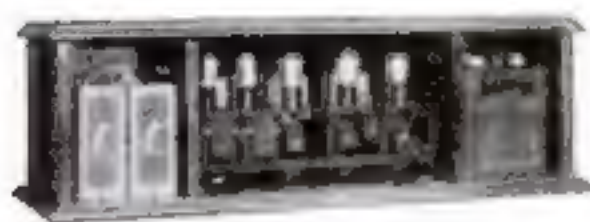
the thoroughness with which every part has been made proof against the interruption of its service, so far as human ingenuity can devise.

Dealers Are Enthusiastic—

over the excitement created everywhere by this unique receiver and the uniform satisfaction felt by its users.

Buy "Solid Value" in Your Radio

The leading wholesaler of radio apparatus in your community has probably been, for years, an ALL-AMERICAN Authorized Distributor. ALL-AMERICAN Guaranteed Radio Products are being shown everywhere by responsible and reliable dealers.



All that you want in a radio—
natural tone, sharp selectivity,
straight-line-frequency tun-
ing (360°) unaffected by posi-
tion of the fingers, extreme
sensitivity, permanence.

ALL-AMERICAN RADIO CORPORATION, E. N. Rauland, Pres., 4215 Belmont Ave., Chicago, U. S. A.



ALL-AMERICAN

Pioneers in the Radio Industry

OWNING AND OPERATING STATION WENR—250 METERS



TRADE

YALE

MARK



The Yale Door Closer

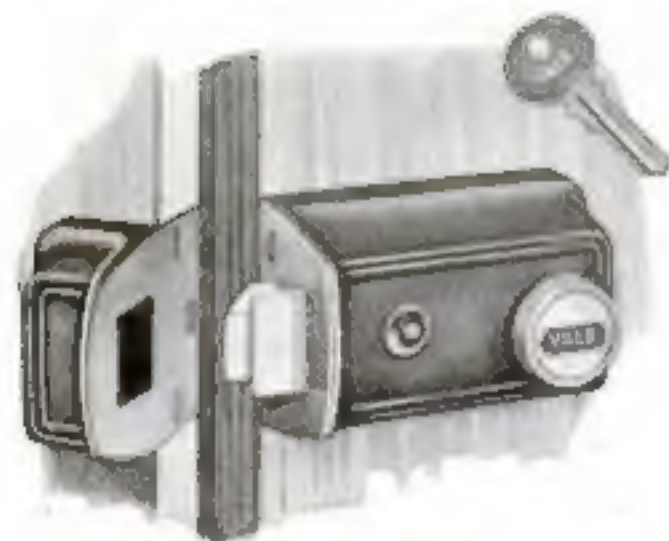
No more than the usual household tools are needed to install Yale products.

The popular Yale Door Closer, for instance, useful and convenient on many doors in every home, may be installed by simply driving a few screws.

The Yale Door Closer is a door-closing power plant: perfect in action; made with the precision of a smooth-running engine; every part co-ordinated to the quiet closing of a door.

As the door is opened the power of a highly tempered steel spring is stored up waiting for release. As the hand leaves the knob the spring unwinds, promptly starting the closing action, and at the right moment, controlled by a piston working within its cylinder against hydraulic pressure, the door gradually loses momentum and comes to a quiet stop as the latch-bolt clicks in the jamb.

This is the action of a Yale Door Closer.



Yale 44 Automatic Deadlatch

The handy man with tools will be delighted at the ease with which a Yale 44 Automatic may be attached to any entrance door.

The Yale 44 Automatic combines the functions of the ordinary spring latch with the security of the deadlock. The beveled spring-latch snaps into the strike as the door is closed and the ingenious mechanism within the lock automatically throws the springlatch forward into the jamb plate almost double the usual distance and deadlocks it there. Full directions are packed with each lock.



Yale No. 840 Padlock

Folks who like to see things kept in their proper places, and expect to find them there when they want them, can make good use of one or more Yale Padlocks.

There are many places about every home where Yale Padlocks should be used. The ease with which they may be put in service, their business-like appearance and the security which they afford, appeal to the man who desires real lock protection.

The Yale No. 840 is a particularly sturdy example—and there are other Yale Padlocks for every purse and purpose.



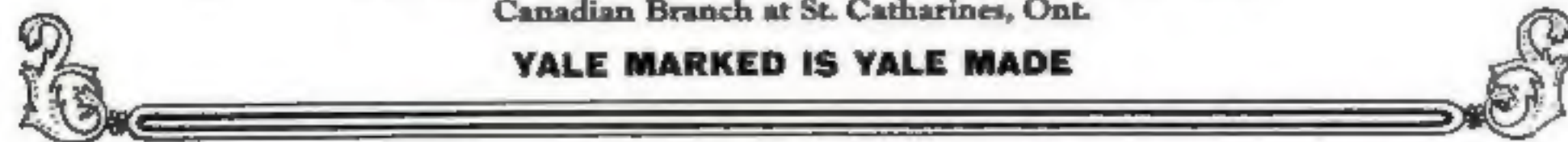
Yale No. 5551 Cabinet Lock

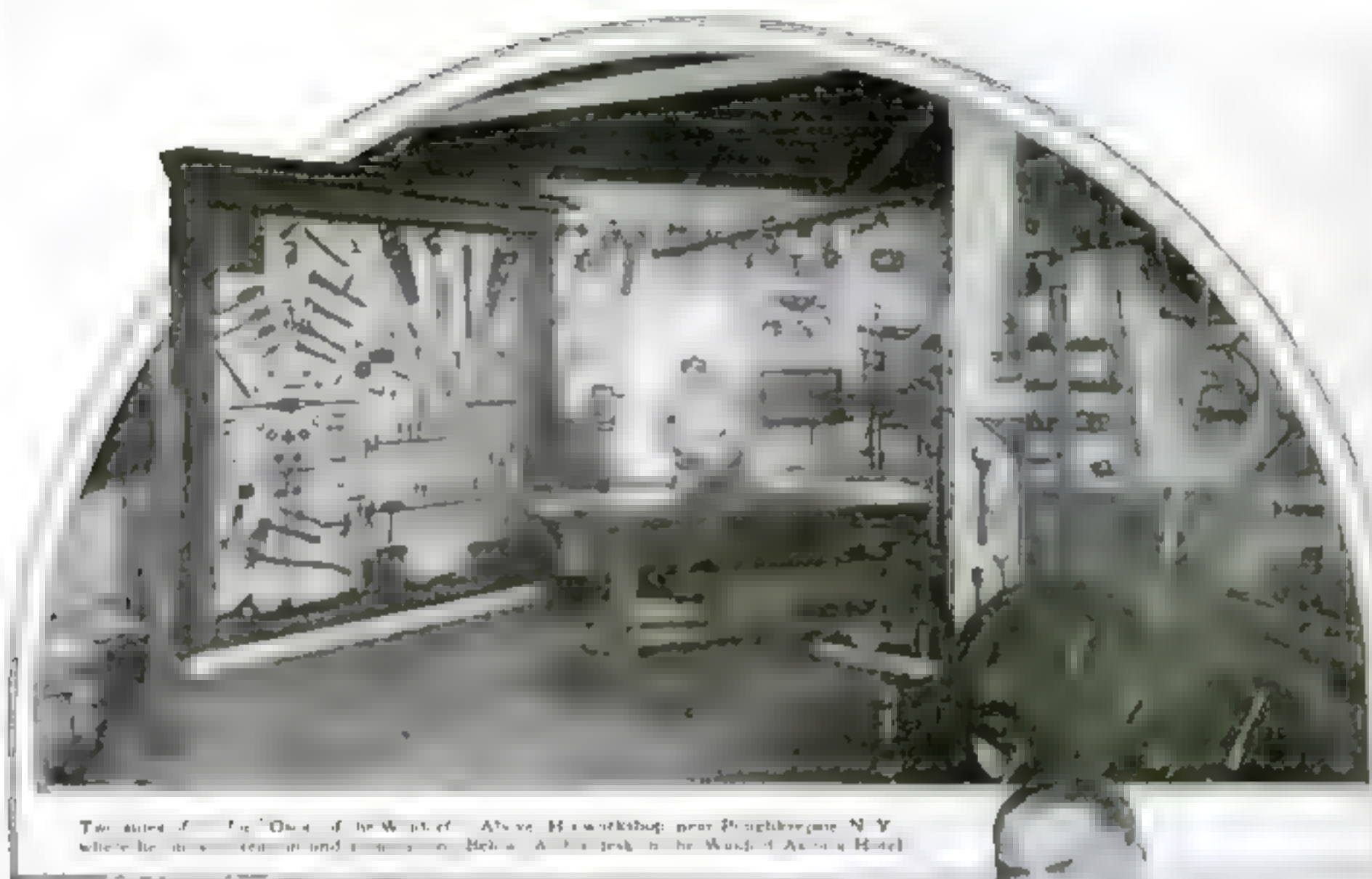
In every home there is always a special drawer or cabinet closet that should be kept "under lock and key."

A Yale Cabinet Lock No. 5551 will do the trick. This handy Yale Lock enables the user of tools to show his skill without the slightest difficulty and provide for himself a private drawer or closet easily, quickly—and secure against intrusion.

The Yale & Towne Mfg. Co., Stamford, Conn., U. S. A.
Canadian Branch at St. Catharines, Ont.

YALE MARKED IS YALE MADE





Two sides of the "Oscar of the Waldorf." Above: His workshop near Poughkeepsie, N. Y., where he does carpentry and repairs on boats. Below: A "lark" in the Waldorf Astoria Hotel.

How Some Men Lead Double Lives

SINCE the early twenties, New York has known Oscar Tschirky, its most popular hotel host. "Oscar of the Waldorf," immaculate, smiling, suave, is part and parcel of Fifth Avenue. Kings and potentates have decorated him. Financiers and statesmen call him their friend. Few men have been known to more of the world's celebrities.

But up in the Catskills they know another Oscar—an Oscar strange to the associates of "Oscar of the Waldorf." There he is Oscar, expert machinist; a master craftsman, proud of his tools and of his shop. Skilled with his hands, he repairs farm machinery, makes hinges and weather vanes, and has built for himself a complete automobile.

For thirty years, Oscar has spent his odd moments in his machine shop. Sheltered from the cares of his workaday world, he has found recreation and stimulation. A good tool in his hands, he says, lulls his mind into tranquillity.

Thousands of us lead such double lives behind the masks of our regular occupations. Maxfield Parrish, the painter, spends all of his spare time in his completely equipped machine shop in New Hampshire. Josef Hofmann, the pianist, William Travers Jerome, the famous attorney, and Ferdinand, King of Rumania, also



find solace and inspiration in the rhythm of revolving machinery.

Walter Prichard Eaton, the novelist, is proud of his carpentry, and Frank Hedley, head of New York's subways, of his ability as a plumber. General Pershing is a good machinist, Henry L. Doherty, the oil magnate, an expert electrician, and Walter Damrosch, conductor of the New York Symphony Orchestra, paints furniture. And the list is long, for in good tools there is a fascination for most men.

KEEP on leading your double life. Honest craftsmanship offers most of us the change from routine our minds need. Folks who spend odd moments making useful things never have to kill time as do the worthless. And remember that it is the little known Oscar of the Catskills who provides the power that makes "Oscar of the Waldorf" famous.—S. N. B.

Grebe
"Colortone"

Flexible Unit Control



The high-wave reception range of the Grebe dial (B) - from 550 down to 240 meters - equals the practical tuning range of the usual receiver. The low-wave range of the Grebe dial (A) provides a tuning reception down to 150 meters.



Grebe
Binocular Coils
Reg. U. S. Pat. Off.
and
Low-wave
Extension
Circuits

Always Well in Advance

THE Synchronphase, as usual, is fully a year in advance of other receivers. This is due to those Grebe developments which have contributed so much to the improvement of radio reception. As past experience will show, these advances may be adopted, perhaps next year, on sets of other manufacturers.

So, in buying a Synchronphase now, you are assured of a receiver well in advance of others, and a quality of reception which they will take some time in equalling, if ever.

*A demonstration by your dealer
will convince you*

A. H. Grebe & Co., Inc., 109 West 57th St., N. Y.

Factory: Richmond Hill, N. Y.

Western Branch: 443 So. San Pedro St., Los Angeles, Cal.

This company owns and operates stations WAHQ and WNDQ; also low-wave re-broadcasting stations, mobile WGMT and marine WRMT.



It is written

"It is foolish to try to graft a bamboo shoot on a cherry tree."

The adding of Grebe developments to other receivers does not put Synchronphase quality into them. Only Grebe can do that.

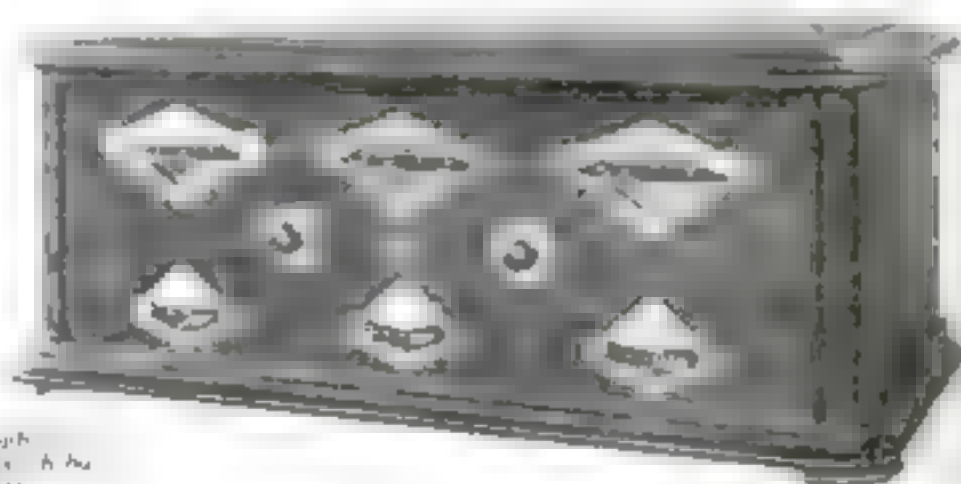
W. L. Grebe



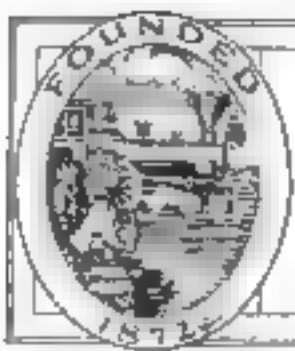
All Grebe apparatus is covered by patents granted and pending.

The GREBE

Synchronphase



The Synchronphase also supplied with a battery base



\$1000 Cash Prizes Each Month

John and Mary Newlywed Return in **A Fascinating Picture Contest**

HERE they are again—John and Mary Newlywed—this time in a fascinating new series of Picture Contests . . . Just the kind of contests that will entertain you and the members of your family during the long evenings. . . . Just the kind to repay you materially in substantial cash prizes. . . . Just the kind that will prove helpful to you in solving the everyday problems about the home. . . . Just the kind, too, that will pay you the largest rewards in what cash cannot buy—the exercise of your mind to wider observation, keener perception, and greater ingenuity.

Beginning with this issue, POPULAR SCIENCE MONTHLY offers \$1000 in cash prizes each month to the readers who prove themselves to be the most observant. Each month we are printing a picture of John and Mary Newlywed busy at some odd job about the home. In each picture John or Mary, or both, are doing, or have done, one or more things in the wrong way. And in addition there are a number of mistakes made by the artist in drawing the picture. The cash prizes—63 in all—will be awarded to those readers who can point out the largest number of mistakes, of any kind, in the picture, and who present their explanations of the errors in the clearest and most skilful manner. Each monthly contest is complete in itself and is open to everybody, everywhere. No expert knowledge is required. You need only be alert and observant.

If you were among the thousands of readers who entered our great \$10,000 "What's Wrong" Contest last summer, you will need no introduction to John and

Mary. If, however, they chance to be strangers to you, it is sufficient to say that this young couple have just established themselves in a new home—a home that is not altogether new nor altogether old. Here they are confronted with many new problems that they meet in their own way, usually with more enthusiasm than skill. They make all sorts of mistakes and get into all sorts of difficulties, some of which you yourself have experienced.

The new contest beginning this month is a sequel to the one that recently ended in that it carries John and Mary on through their adventures in homemaking. While the best features of the former contest are being retained, new and unusual ones have been added.

In the previous contest you were asked to point out only a single mistake made by John or Mary, and a single mistake made by the artist in drawing each picture. In the new contest there are several mistakes in each picture, both John's and Mary's mistakes and the artist's mistakes. You are to see how many of these mistakes you can find, and tell us why they are wrong. Here's the way to go about it:

First turn this page and read the rules of the contest carefully. Then study the picture in this month's \$1000 contest. This you will find on the page opposite. Here you see John and Mary at work on their car. What things are they doing that they should not be doing, or what things are they doing in the wrong way? Now study each detail of the drawing carefully. Does everything look as it should look? What objects in the picture appear to have been drawn in the wrong way?

One of These Prizes May Go to You

ONE thousand dollars in cash prizes will be awarded each month to the winners in a remarkable series of contests starting in this issue. There will be a complete contest each month in which the prizes will be distributed as follows:

First Prize	\$ 500
Second Prize	100
Third Prize	50
10 Prizes, \$10 each	100
50 Prizes, \$5 each	250
Total Monthly Prizes	\$1000

How many mistakes can you find? Get out your pencil and paper. Jot down each mistake as you find it, explaining as briefly as possible why it is wrong. When you have listed all the mistakes you can find, copy the list neatly with typewriter or pen and ink, numbering your answers in order, and send it in to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City. Remember to write on one side of the paper only, and to write your name and address plainly on each sheet of your contribution.

If, when you have completed your list, you feel that you may have overlooked some of the mistakes, you are at liberty to call on your friends or neighbors for assistance. If, too, after you have sent in your entry, you discover additional mistakes in the picture that you overlooked, you can send in another and more complete entry. In fact, you can send in as many separate entries as you wish. Additions and corrections for entries already submitted will not be accepted.

WATCH FOR NAMES of the winners of \$6000 in Grand Prizes in our great \$10,000 "What's Wrong" Contest which was completed last fall. These awards will be announced in next month's issue. Of course you'll want to know who has won the First Grand Prize of \$2500; the Second Prize of \$1000; the Third Prize of \$500, and the other 305 prizes. The complete list of Grand Prize awards will be published in our April issue, on the news-stands March 10.

All entries in this month's contest must be mailed or delivered to the Picture Contest Editor not later than March 30. This should give you ample time to study the picture and fill out your list of mistakes.

You'll find this new competition not only fascinating and entertaining as a pastime, but exceedingly helpful. In the previous "What's Wrong" Contest, hundreds of readers wrote to us telling how their study of the problems of John and Mary helped them to solve their own problems about the home.

"This contest has proved a veritable 'Thousand and One Nights' Entertainment," wrote one young couple; "and in the end it has left us both wiser and with a fuller knowledge of what to do and how to do it in our home and surroundings. Many of the solutions were found in the pages of POPULAR SCIENCE MONTHLY, others, through the knowledge that comes only with experience. All in all, we can truly say we have enjoyed to the utmost this beneficial schooling in the care and management of an institution we all should cherish—the home."

Hundreds of other readers have told us that the "What's Wrong" pictures proved helpful in stimulating

The Rules of the Contest—Read Them Carefully

1. Each month, beginning in this issue, and until further notice, POPULAR SCIENCE MONTHLY will print a picture of John and Mary Newlywed doing some simple job about the home. Each picture will show John or Mary, or both, doing one or more things in the wrong way and, in addition, there will be a number of deliberate mistakes by the artist in drawing the picture. You are to tell us what things are being done wrong and what things are drawn wrong in each picture, and why they are wrong.

2. POPULAR SCIENCE MONTHLY will award \$1000 each month in 63 cash prizes for the best answers giving the greatest number of mistakes in the picture. These cash prizes will be distributed as follows:

First Prize	\$500
Second Prize	100
Third Prize	50
Next 10 Prizes, \$10 each	100
Next 50 Prizes, \$5 each	250
Total Cash Prizes	—
each month	\$1000

3. Prizes will be awarded to those persons who point out the largest number of actual mistakes found in the picture and who present their explanations of the errors in the clearest and most skilful manner. Actual mistakes shall be construed in all cases to mean mistakes appearing in the picture about which there can be no question in the opinion of the judges. In case of ties, the full amount of the prize will be given to each tying contestant.

4. Answers to each picture must be mailed or delivered to the office of POPULAR SCIENCE MONTHLY not later than the thirtieth of the month following the date of publication of the magazine in which the picture appears. Thus, to insure consideration in this month's contest, answers to the picture in this month's issue, published February 19, must be mailed or de-

livered not later than March 30. No entry bearing a postmarked date later than the closing date for entry will be considered.

Another Contest Next Month

THE second \$1000 Picture Contest of this remarkable series will appear in next month's issue. Watch for it. Other similar contests will appear in succeeding issues of POPULAR SCIENCE MONTHLY. Each will be a complete contest in itself. Thus, if you should fail to win one of the cash prizes one month, you always will have as good a chance as any one to win a prize the next month.

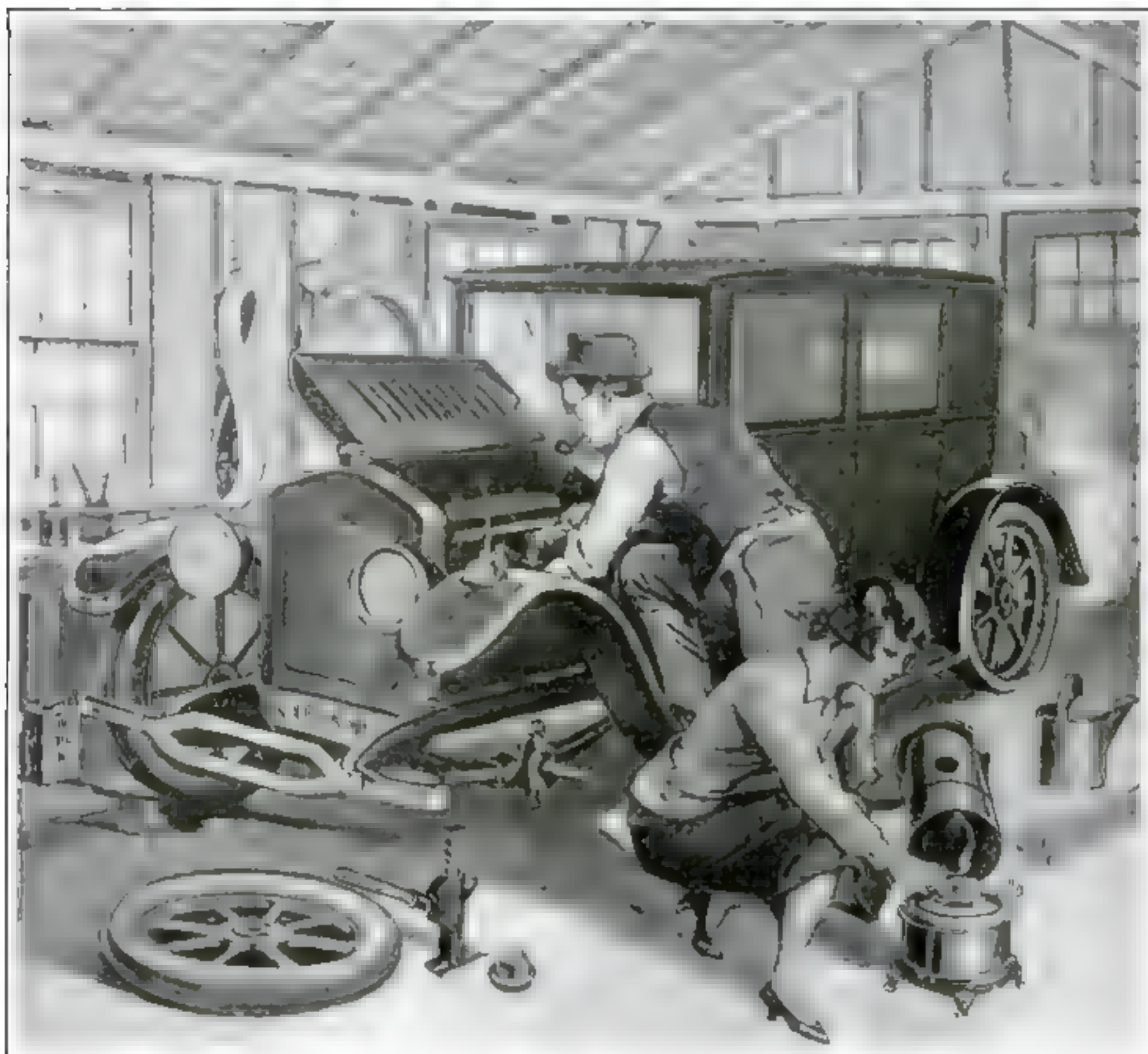
5. Answers may be submitted on any kind of paper, but they must be typewritten or written in ink, and on one side of the paper only. Each error must be listed separately and numbered. No

6. All entries should be addressed to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City. Name and address of the entrant must be written plainly on each page of the entry. Entries with insufficient postage will not be accepted. The publishers cannot be responsible for delay, loss, or non-delivery of entries. No contribution entered in this contest will be acknowledged and none will be returned. No letters of inquiry regarding points covered in the rules can be answered.

7. You pay nothing. Just prove your knowledge and observation. You need not buy POPULAR SCIENCE MONTHLY to compete. You can borrow a copy from a friend or you can examine one at any office of POPULAR SCIENCE MONTHLY or at public libraries free of charge. Each contest is open to everybody, except employees of POPULAR SCIENCE MONTHLY and the Popular Science Institute of Standards and their families.

8. Officials of the Popular Science Institute of Standards will act as judges and their decisions will be final. Acceptance of these rules is an implied condition of each entry.

How Many Mistakes Can You Find in This Picture?



IN THIS picture John and Mary Newtred are seen in the garage at work on their car. They are doing, or have done, one or more things in the wrong way and in addition the artist has made a number of mistakes in drawing the picture. How many mistakes can you find?

POPULAR SCIENCE MONTHLY will pay \$1000 in cash prizes to contestants who point out the largest number of mistakes and present their explanations of the errors in the clearest and most skilful manner. The game is fascinating and the prizes worth going after. Read the rules on page 12.

their minds. In exactly the same way this new contest will help you train your mind to make a record of the things you see. It will make you more wide awake and more observant.

To compete successfully, you do not need to be a handy man nor do you need any special artistic ability. The errors in the picture are of a kind that almost anyone should be able to discover after a little study. And remember, you can always ask your friends for help if you feel you need it.

You'll find it as fascinating as a game. Perhaps you will be able to find in the picture mistakes which even the artist was not aware of when he drew it. In your enthusiasm, however, don't try to manufacture mistakes out of things that are obviously correct. You must suggest the correction for every flaw that you find.

The officials of the Popular Science Institute of Standards will be the judges in this month's contest and in each succeeding contest.

Their decisions in all cases will be final. In case a number of contestants submit the same number of mistakes, the selection of the winners will be based on clearness and skill in presentation. In case of ties, a duplicate award will be given to each tying contestant.

Are you ready to go? In the hunt for mistakes there's a lot of real fun in store for you, and, if you look sharp, a fine chance to win big rewards.

America's First Scientist

*A Mysterious Genius
Labored in Mexico
Long before Christ,
Says Noted Explorer*



A Timepiece in Stone

This ancient Mayan calendar, now deciphered, reveals a system of measuring time more accurate than any other the world has known.



Solved Mayan Calendar

Dr. Herbert J. Spinden, of Harvard, who recently revealed the existence of a master scientist on the American continent in 613 B.C. is shown above. Dr. Spinden is now on his fifteenth expedition to Yucatan where he is deciphering more of the strange monuments left by the long vanished race of Mayas.



Dated: 513 A.D.

Interpreted at last, the inscription on this richly carved stele at Copan, Honduras, marks Mayan culture at the height of its expression.

Spinden calls "a figure grand and mysterious as Zoroaster or Buddha at the beginning of history in Persia and India."

The Mayas at this time lived on plains where a six-month period of rain every year gave great fertility to the soil, permitting the people to raise two crops a year if their planting and reaping were properly timed. The necessity for accurate timing in planting the crops was the incentive which resulted in the marvelously precise timekeeping system.

"Hundreds of native dates found on Mayan monuments and temple walls have been translated into our calendar," says Dr. Spinden, "and evidence of their highly scientific methods and the extremely accurate results which they obtained in their calculations increases with further research. The Mayas reached practically the same figure for the true length of the year that we have today. They made calculations over vast stretches of time. Their calendar was more accurate than our own which has an error of one day in 3,500 years."

How this great nation fell from the heights of grandeur, archaeologists do not know. Its passing is one of the tragedies of history, for while some 14,000,000 cultured people inhabited Yucatan and Central America in the days of the mysterious great scientist, less than 1,000 ignorant, impoverished Indians now are all that remain of the Mayas.

MORE than 2,500 years ago, there lived on the American continent a great scientist, a genius who made startling discoveries and formulated important principles in mathematics and astronomy that antedated by centuries the first attempts of the fathers of our modern science to peer beyond the veil that shrouded them from knowledge of their world.

No one knows the name of this wonderful ancient savant. It may remain forever a mystery. His fame, though, is made everlasting by his amazing work, the purport and importance of which were discovered recently by Dr. Herbert J. Spinden, distinguished archaeologist of Harvard University.

Dr. Spinden, by deciphering the inscriptions on the ruined temples and crumbling stone houses found in Guatemala and Honduras, has proved definitely that the Mayas who built them were a highly cultured, civilized people.

That these people inhabited the western hemisphere centuries before Christopher Columbus' time has been known, of course, but it remained for Dr. Spinden to fix definitely the time at which these early Americans reached their highest state of culture, which was in the seventh century after Christ. And now he has finally succeeded in checking up the Venus calendar of the ancient Mayas with the true astronomical positions of the planet Venus in the sixth century before the Christian era.

These latest investigations prove beyond doubt that the mysterious unknown scientist developed, by abstruse mathematical calculations, and observation of astronomical phe-

nomena, a system for measuring the passage of time that is more accurate than any other method. In fact, this amazing man was the constructor of a machine for timekeeping that worked without error for almost 2,000 years! This marvelous machine was destroyed by fanatical priests during the terrible Spanish Inquisition. This act of insane vandalism was directed by Bishop Landa, who was also responsible for the burning of all the native records of the Mayas. Afterward, he was recalled to Spain and placed on trial for his cruelties.

Dr. Spinden's recent discovery makes it possible to translate the dates on the ancient inscriptions into the Gregorian calendar we use today. All of these records show vaguely yet unmistakably the influence of the great man whom Dr.



Sighting the sun from one of these markers to another, told the Mayas the time of year.

How Test Tubes Solve Crimes

The Story of a Remarkable Police Laboratory Where the Thinnest Thread Gives a Clue

By G. B. SEYBOLD

TWO MEN, good friends for years, had quarreled. One night one of them, stepping out of his home, saw a man rise from a stooping position near the front porch and disappear around the corner. Under the porch he found a bundle of oil-soaked rags. Inside it was a chunk of sulphur. A piece of oil-soaked string, with one end around the bundle, had been lighted, evidently to act as a slow fuse.

The former friend was suspected, but he offered a good alibi, and the case seemed balked. Twenty years ago it might have been.

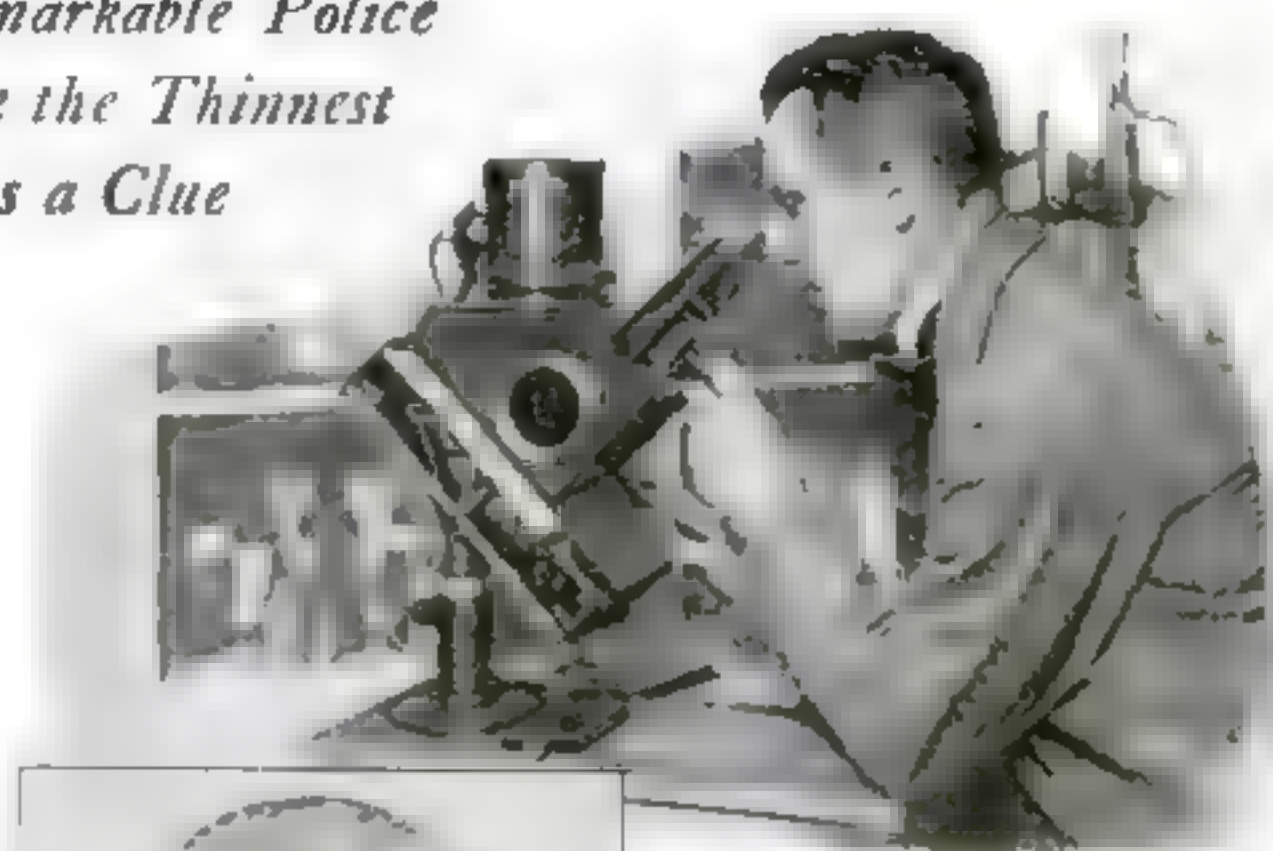
The oil-soaked string was taken to a chemist at Police Headquarters in New York City, where recently has been installed one of the strangest laboratories in the world, a bureau of criminal science, devoted entirely to solving crimes. High-powered microscopes, X-ray apparatus, ultraviolet light machines, remarkable photographic equipment and delicate instruments to weigh, measure, and identify mere specks, are the most dangerous foes a criminal ever met. They do not lie; their evidence cannot be disputed.

Now, two bits of string that may appear alike to the human eye, are as different, under a powerful microscope, as black is from white. Jute hemp, and cotton are all used in string and each has individual characteristics.

THE police experts showed conclusively that the fiber in the oil-soaked string was identical with that in string used in the factory where the former friend was employed. Confronted with this amazing evidence, the man confessed.

At the head of the laboratory is a captain of police and on his staff is Edward J. Kelley, an expert chemist, who for twelve years has tested the material "exhibits" in criminal cases. A number of assistant chemists and patrolmen, all trained in some special branch of this work, spend their full time at the bureau. With it is connected the laboratory of Charles E. Waite, described in the January issue of *POPULAR SCIENCE MONTHLY*. There bullets and the barrels of guns are examined to identify the pistol from which a bullet has been fired. Lieutenants all over New York City send material from the scenes of crimes to the bureau, where it is examined and later used as evidence in court.

About three years ago, in an old house on Washington Square in New York City, a robbery



A Wonderful New Microscope

Edward J. Kelley, head chemist of the New York City Police Department, is looking through the new microscope. It is a powerful instrument, capable of magnifying objects up to 10,000 times. It is used to examine evidence in criminal cases.



The Latest in Finger Prints

Identification of a criminal is made more certain by this new method of taking finger prints by which an X Ray of the finger bones and joints is made on the same plate with the skin whorls. Thus a double record is made.

took place that startled the whole country on account of the daring and cruelty of the thieves. Mr. and Mrs. Alfred Shattuck were locked in a wine closet in

the cellar and left to suffocate, while the robbers escaped with jewels.

Within a week of the police, the Shattucks hunted down the ring of criminals, tracking them to Europe, and eventually the entire gang was sent to prison.

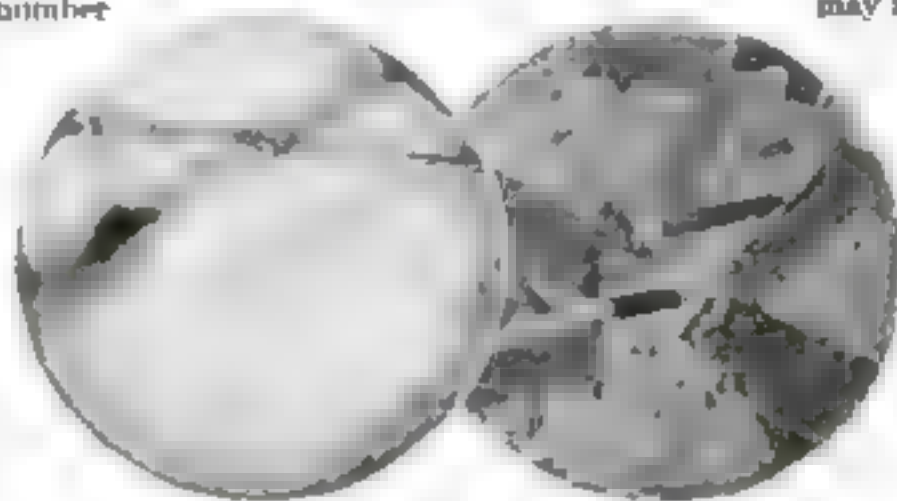
In one of the European crime laboratories, Mr. Shattuck discovered an instrument called a dactyloscope, a microscope of tremendous power, especially designed for examination of criminal evidence. It magnifies finger prints so powerfully that even the shape of the sweat pores can be examined. The Shattucks presented a dactyloscope to the newly established crime laboratory in New York in appreciation of the work done by the police.

Finger prints are the most incriminating evidence in existence. A single print may furnish a sufficient clue.

Late one night last spring a speeding automobile in an outlying district of New York City ran into a police sergeant and killed him. His body was carried two and a half blocks on the front fender, before it dropped to the pavement.

The car was found abandoned a few blocks from the crime. The owner admitted that it belonged to him, but declared that it had been stolen from in front of his home. Apparently there was nothing to connect him with the dastardly deed.

In the impact with the policeman, however, the windshield had been smashed, and bits



Clues in Tiny Bits of Thread and Wood

Left: A single minute strand of cotton fiber (highly magnified) from the coat of a man, which proved he had taken part in a mail riot. Right: Magnified bits of wood and wood fiber which established the identity of a murderer, after other clues had failed.

of glass scattered about. On one of these a single finger print was found.

Under the dactyloscope, this finger print was found to be that of the owner of the car. Undaunted, the owner exclaimed: "What's that? A man gets his finger print on the windshield of his own automobile! Of course it's my print."

UNCONVINCED by the man's pose, a detective fitted the broken glass into the frame of the windshield. The finger print was seen to extend beyond the bevel of the glass, to the edge covered by the frame. The print could only have been left there after the broken glass had been pulled out of the frame. This was such conclusive evidence that the owner had been with the car after the accident, that the man dropped his bluff and pleaded guilty.

With nothing but a single thread to guide him, an expert detective has been known to point to the guilty man. Some time ago a strike was in progress at a garment factory. On several successive nights some one succeeded in getting into the building and caused great damage by throwing acid on bolts of silk. Eventually the police caught a former workman in the factory, but released him when he gave a satisfactory reason for his presence.

An observant officer, however, had noticed a small hole in one of the workman's trouser legs. He made a careful survey where the destroyed silk had been piled. On a nail he found three tiny wool fibers. A laboratory examination showed they were identical with the material in the workman's trousers. Thus three



A Telltale Finger Print

This finger print, on a piece of broken windshield, brought confession from a man whose car ran over and killed a police sergeant. In the impact, the glass had been smashed. The guilty man protruded there was nothing significant in his own finger print on his own car. Then a detective fitted the piece of glass into the windshield frame. The print was seen to extend to an edge of the glass wholly covered by the frame before the glass was broken.

Analyzing Poison in a Murder Mystery



A view in the chemical laboratory of the new criminal science laboratory in New York City. At the left in the picture is Edward J. Kelley, head chemist; and at the right, Captain John A. Golden, first chief of the bureau.

threads helped send that workman for a long visit to the penitentiary.

DUST too fine to be observed with the human eye can provide a solution for crime. In one instance the coat of a murder suspect was beaten in a dust-proof bag and cleaned with a vacuum cleaner. Examination of the powdery dust showed that it had come from the floor of the factory where the victim was killed.

Detective methods of yesterday are obsolete today. Poking about, fingering this and that, detectives frequently raised important evidence.

Today a group of detectives goes out on every murder case. Before anything is disturbed, a photographer, using a camera with a special lens that takes in every detail of the room, photographs the scene of the crime. Then at any time afterward the exact details of the scene can be studied for clues.

In addition to the photographs, the detectives plan to have sketches made. These will be drawn with a number of angular measurements, using a scale based on the metric system. They will record the position of the body and its relation to other objects in the room.

A photo micrographic camera photographing the infinitesimal is used to identify internal structure, such as crystals in drugs. For things so small that waves of ordinary

When Teeth Left Their Marks

From a half eaten cake abandoned by a gangster who had broken into a baker's shop, detectives made the cast shown below, which revealed the peculiar markings of the culprit's teeth. Within 48 hours he was arrested and his conviction followed.



light are too long to record them on a photographic plate, a camera using ultra-violet light will be used.

Plaster casts and wax impressions are taken of foot prints and automobile tracks, so that these may be kept as permanent records.

AMONG the many instruments used by the chemists of the bureau is a Dubosq colorimeter, employed for examining blood. This instrument not only shows whether there is any blood in a stain, but also the exact quantity, without injuring the article examined. A speck of blood is sufficient for examination in the colorimeter. Even minute specks of blood (harmed under a fingernail) may be enough to accuse a man of murder.

Chemical examination is playing an increasingly important part in modern methods of detection. A thief who not long ago terrified residents in a suburban section of New York worked on a system. He would rob a row of houses in one block one night, go off to another section the next night, and on the third return to work in the first district where he had left off. Every where he went he dropped old-fashioned salpiter matches which strike noiselessly.

A close watch was put on the neighborhood where he was next scheduled to appear. A suspect was seized and questioned. Although he protested his innocence, in his pockets were found sulphur matches which analysis showed were of the same kind left in the trail of the robberies. A bunch of pawn tickets confirmed the evidence that brought conviction.

Hundreds of suspected poisons are examined in the laboratory. Mr. Kelley, chief chemist, tells this story:

"Some years ago a Brooklyn fruit dealer



Proof of a "Raised" Check

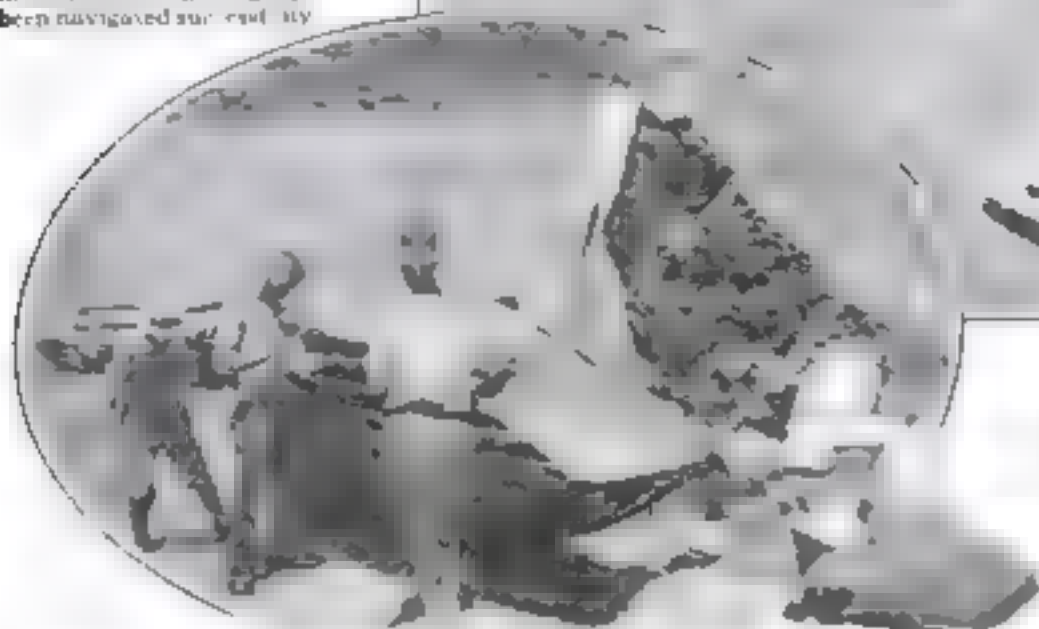
This greatly enlarged photograph revealed clearly how the figure 7 had been converted into a 9 on a bank check. You can see the joints where an additional line was added in order to enhance the value of the original figure.

Spectre Chasm Dam

Right During government explorers surveying site of Spectre Chasm Dam, indicated by dotted lines. This dam would be 223 feet high developing 255,000 continuous horsepower.

The Surveyors

Below U. S. Geologic Survey men repairing bridge over falls constructed here at the foot of Ranger Creek Rapids. Only here since a highway has the giant gorge been navigated successfully.



Caging a Fierce Canyon Stream

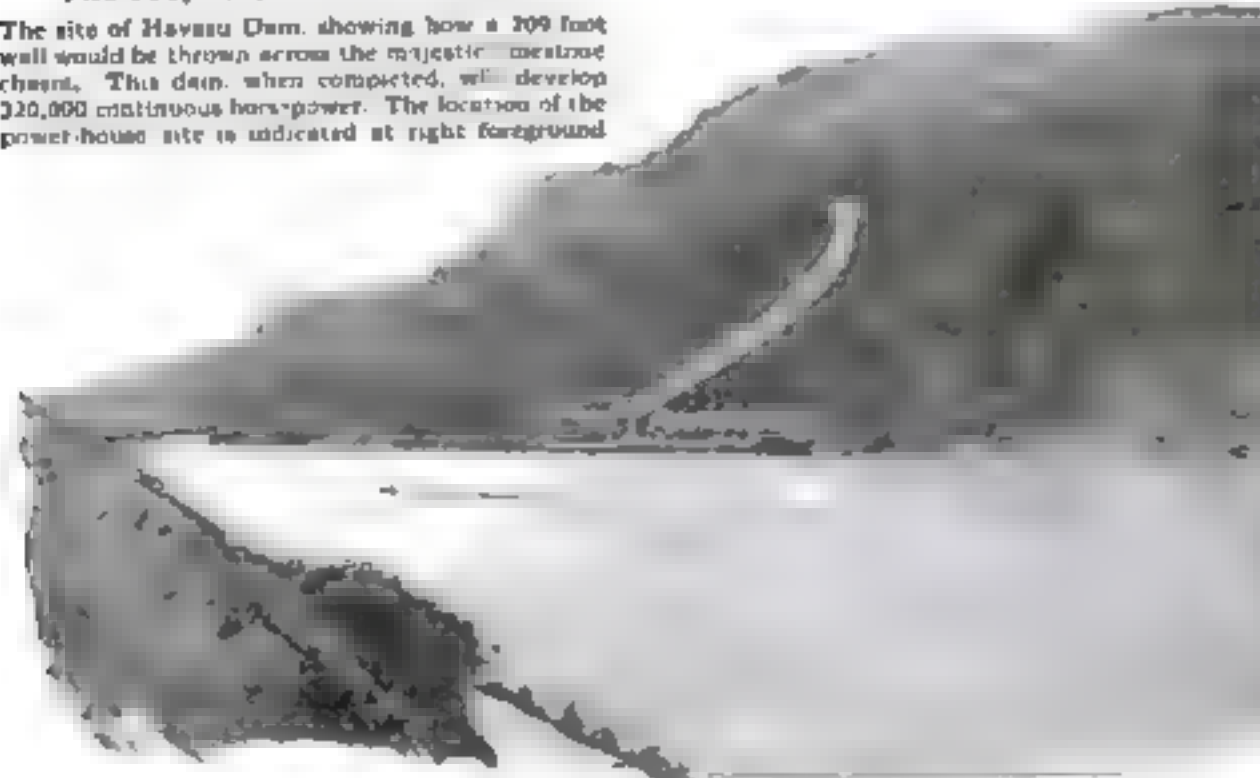
AFTER hours of hard surveying and map making, government engineers recently announced details for the huge government project to tame the seething Colorado River and transform the Grand Canyon of Arizona into a scenic storage basin for power and irrigation.

The plan calls for a series of 19 dams that will enable the region to take more than 5,000,000 electric horsepower from the river, and at the same time use the waters for irrigating 11,000,000 acres of desert land. The 19 dams would create 2,000 square miles of lakes, accessible to tourists. The scenic wonders of the Grand Canyon would be left undisturbed.



The Proposed Havasu Dam Site

The site of Havasu Dam, showing how a 200 foot wall would be thrown across the majestic meandering channel. This dam, when completed, will develop 220,000 continuous horsepower. The location of the power-house site is indicated at right foreground.



This picture gives you a good view of the Colorado River below the site of the Glen Canyon Dam. Observe the clearly indicated location of a proposed spillway and powerhouse site.



Government explorers surveying a side canyon of Grand Canyon during their recent perilous trip in which they selected dam and power sites to supply the West with more horsepower.

Folks Who Fly

*Doctors, Salesmen, Sportsmen
Now Travel the Sky Roads—A
Remarkable New Flying Auto*



An Item of Merchandise

The airplane has advanced so far into the practical utility class that a New York department store now displays this all-metal monoplane as one item in its regular stock. A salesman of the store is seen in the picture above showing the machine to prospective customers.

BY EDGAR C. WHEELER

FROM Germany recently came word of a spectacular and amazing development in the field of aeronautics—a flivver plane that is at the same time an automobile, a machine only 18 feet long and less than six feet wide when the wings are folded back, small enough to be housed in the ordinary one-car garage!

This unusual automobile-airplane, the invention of J. H. Maykemper, a civil engineer of Frankfurt, Germany, is pictured in accompanying illustrations and on the cover of this issue. Throwing one lever on this machine transfers the power from the road wheels to the air propeller so that if you were traveling by road and you desired to take to the air, the wings could be snapped out into place and a short run of 100 yards or so would see you soaring skyward. Although the engine is only 20 horsepower, the inventor claims that it will carry a pilot, a passenger, and enough gasoline for a five-hour flight.

Another promising air flivver was recently designed by A. K. Peterson, pilot and chief photographer at the Naval Air Station, Annapolis, D. C., who declares his 40 horsepower machine will hop off from any back yard 100 feet long, fly 100 miles an hour, and travel nearly 25 miles on a gallon of gas.

BUT who would buy such airplanes today? What are they being used for? Do these and similar developments mean that the flying machine, after 22 years of experiment, is coming into its own at last, to take its place beside the automobile as a commonplace conveyance which any man of ordinary circumstances can own and operate?

Such queries as these have come in increasing numbers of late from readers of POPULAR SCIENCE MONTHLY. And be-

The Doctor's Car

Dr. Herman J. Neubauer of Hickory, Ill. (left), standing with his pilot at the propeller of his two-seater biplane, which saves him precious time in making rural calls.

cause they are questions which concern all of us, the editor asked me to see if I could find the answers for the aforesaid queries.

Airplanes are being sold for personal use. Aside from those sportsmen who follow the game for the thrill of it, others are taking it up because the airplane is a wonderful time-saver. One hundred miles can be covered in an airplane in less than an hour. On good roads it would take about four hours to cover the same distance by auto, and even a railroad express train would, without doubt, use up two-and-one-half hours for the same trip.

In fact, the airplane has advanced so far into the practical utility class that at least one New York City department store now carries an all-metal monoplane as one item in its regular stock.

By an odd coincidence, it was on the anniversary day of the Wright brothers' first successful flight that I was in the office of Richard F. Hoyt, a leading Wall street broker, and heard him talking over the telephone. His side of the



Courtesy "Aviation"

Enter—the Flying Salesman

In the Oklahoma oil regions, where distances are great and train service poor, W. C. Brown, a district sales manager at Tulsa, follows the sky road when he calls on his "prospects." His biplane saves him many hours and is good advertising.

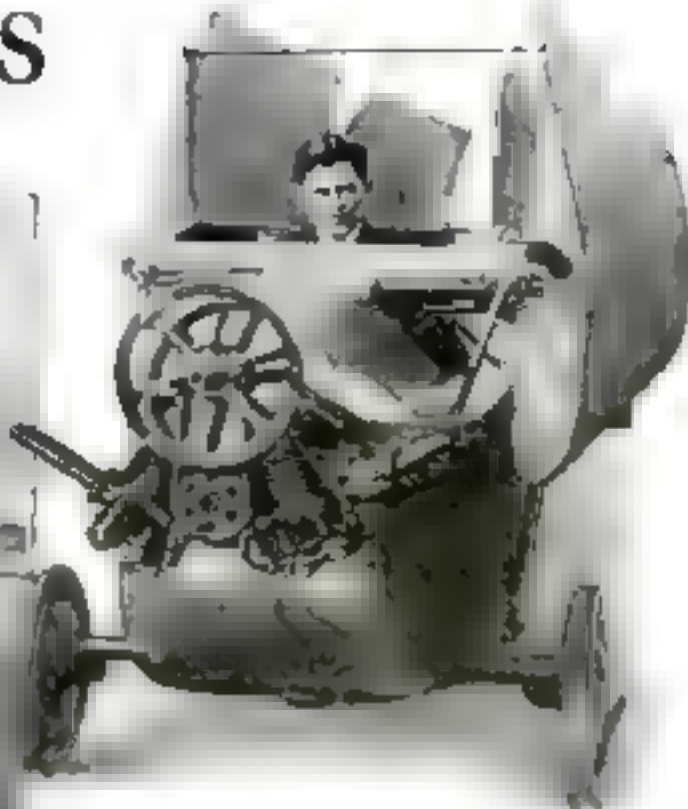
conversation ran something like this:

"Hello, George. . . . Hear you're going to Palm Beach this week. . . . Say, when you stop in Jacksonville, would you mind looking around to see if you can find me a good flying boat. . . . Yes, a good one, no junk. . . . I want to fly it down to Miami. . . . You see, I'm planning a trip to Birmingham in a couple of weeks to look over some property. . . . Thought I'd run over to Jacksonville and fly down the coast. . . . Trains from Jacksonville

Their Own Airplanes

Auto and Plane Combined

At the right are two views of the remarkable new combination flier-car plane and automobile, with its inventor, J. H. Maykroper, of Frankfurt, Germany. One picture shows the machine as an airplane, with propeller in place and wings unfolded. The other shows how the wings are folded when the machine is used as an automobile.



An Aerial Sportsman

James Otis, wealthy importer and sportsman of San Francisco, starting on a hunting trip into northern California in one of his planes. He is seated behind his pilot and mechanic.

always do. For traveling in comfort and saving

time on a pleasure trip, give me my airplane every time. I am a thorough believer in the airplane. It beats a train, a motor car, a motor boat, or any other means of travel you can think of.

Well, here was one answer—an enthusiastic one—to the question of who buys private airplanes, and why. Like Vincent Astor, Harold Vanderbilt, and other young men of considerable means, Mr. Hoyt has found it convenient—and a lot of fun—to commute in a flying boat from his office to his home in the country. Every summer for four years he has made week-end trips in the air to his home in Marion, Mass., on Buzzards Bay, or to Cape Cod.

But isn't it a bit hazardous?" I suggested.

"Don't you believe it!" he shot back. "There's altogether too much said about accidents and crashes. It's no trick to drive a plane. The way they're building machines now, flying is no harder than driving a car, about the only difference is that you drive in three dimensions instead of two.

"OF COURSE, I have had minor troubles, just as you would have with your car. Two or three times I've been forced down. Once my propeller burst; another time there was a leak in the gas tank. But it really wasn't very much trouble. All I had to do was to glide down to the water and sit there and wait until

a boat came along to tow me to shore. As for expense, the cost of running a good airplane nowadays is only a trifle more than that of running a good automobile.

"AND this year," Hoyt told me, in the casual way that he might have discussed the purchase of a new coupe or sedan, "I am planning to buy one of the new Wright-Bellanca biplanes—a 200-horsepower machine that carries six passengers in an all-enclosed cabin. It will fly 180 miles an hour and eight miles to the gallon of gas. I intend to attach pontoons and make a flying boat out of it."

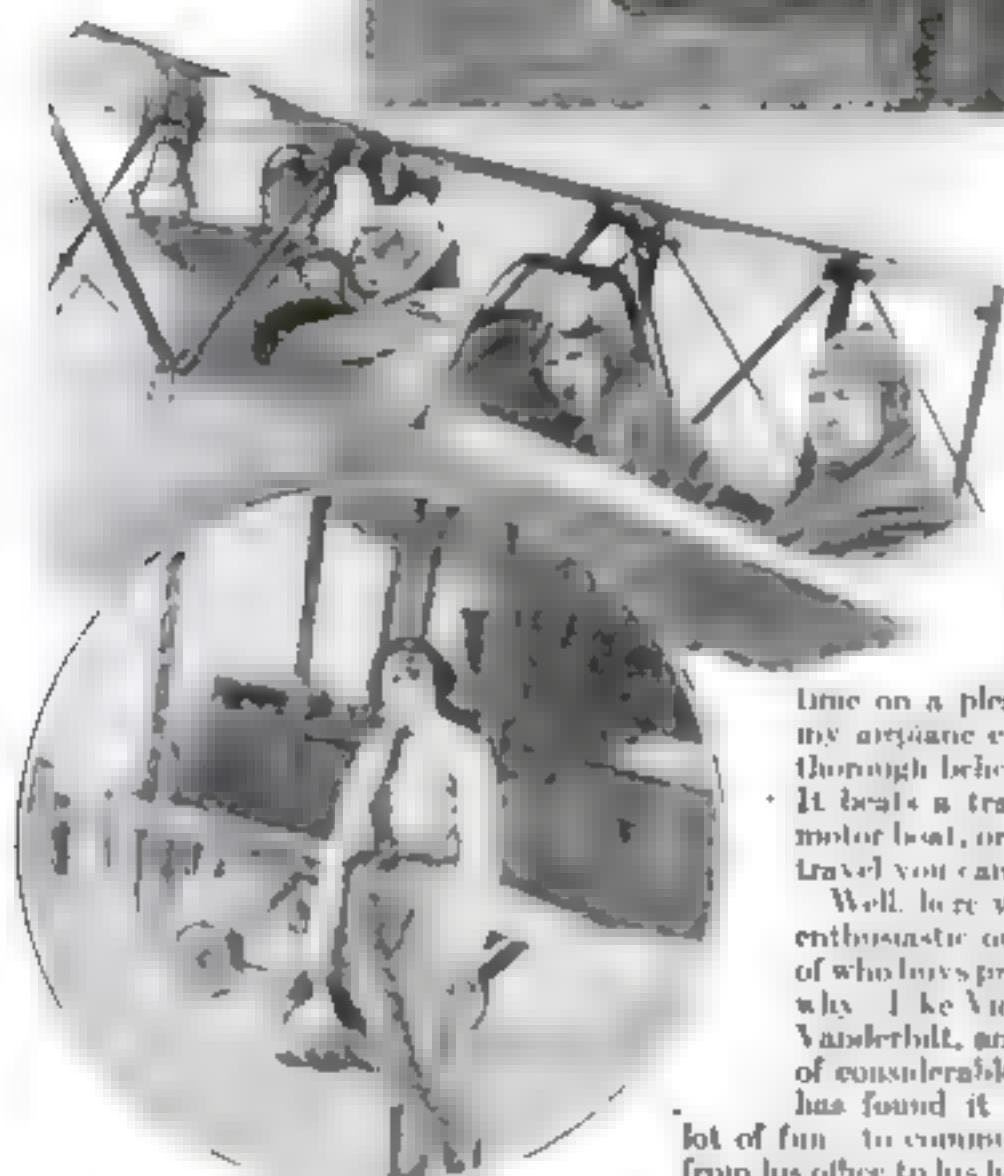
Numbers of other men and women today are buying aerial motor cars and flying them for business or for pleasure. There is the salesman who swoops down from the sky to call on a prospective customer, the doctor who rushes through the air to a stricken patient; the business executive who travels as the crow flies from office to factory or from the city to his home in the country; the sportsman who takes to wings for his fishing and hunting trips.

IN THE Oklahoma oil region, for example, there is W. C. Brown, the Tulsa district sales manager for a Massachusetts manufacturer of recording instruments. Almost any day he may be seen in his plane darning oil derricks, or scouting down between rows of tanks at a refinery. Trips which once required two days or more on the road now are reduced to short hops of a few hours. Even if a prospect is some 300 miles from Tulsa, this former Air Service pilot can climb into his biplane in the morning and hop off with the assurance that he will be back home again before evening. Never has he had a serious mishap. He buys his airplanes as other men would buy automobiles. When one machine wears out, he buys a new one. Thus far he has used four planes in his business.

Or there is Milton P. Miller, known as "The Flying Peddler," who sells toy airplanes and travels by air through the states of Illinois and Ohio.

There are indications, too, that large business houses are preparing to put salesmen and representatives into the air.

(Continued on page 247.)



Hunts Big Game by Airplane

Mrs. Midge Jauregui, famous woman hunter, of Tampico, Mexico, whose flying machine carries her into the remotest as well as most inaccessible mountain regions in search of big game.

down are all tied up, I hear; some 10 hours late . . . Figure I can save at least a day by air if I can get hold of a good boat . . . Remember, though, I can't use any junk . . . Thanks, old man.

To many of us, even after 22 years of flying, the airplane still remains a thing more or less mysterious, a machine to be handled only by daring bird-men. But to this rather young, athletic-looking New York business man a swift journey by air apparently was an old story, almost as commonplace as a motor trip.

"You mean to fly that plane yourself?" I asked him.

"Why, of course," he replied, "I

Marvels of the Electric Home

*How New Inventions Utilize
Electric Light, Heat, and
Power in Every Room
of the House*

ELECTRICITY is changing our homes so swiftly and yet so smoothly that the younger generation today can scarcely conceive of things as they were only a few years ago.

One marvelous device after another has been suggested, invented, and perfected. One makes a house look as if it had been taken by magic from the past. The electric washer and ironer are providing a new race of housewives. The vacuum cleaner was brought into use out of the annual custom of spring housecleaning. The electric refrigerator promises to make the ice-man a picturesque memory. Electricity cools us, warms us, and cooks our food.

Every nation has its ideal home. In the electrical home, it seems, America has found its own ideal. Partly responsible for this is our lack of groove-bound traditions, partly, the activity of our scientists, electrical men and inventors. At least the ideal we are offering the world is something entirely new—that of a home beautiful and comfortable, but, above all, easy to run.

It is not often given to inventors and scientists to see the direct fruits of their labors so strikingly benefiting their own generation. Even more inspiring is the thought that there are countless electrical inventions yet to be made.



In the picture our artist has suggested a few of the ways that electrical invention is changing traditional methods of doing household tasks. Even the children play with electric toys while the housewife reaches for the radio music. Every room has benefited by electricity's service of light, heat and power.

Can a Bald Man Grow Hair?

*Don't Believe Everything
the Barber Tells You—New
Theories about Thin Locks*

A CHOICE niche in the Hall of Fame is here reserved for the scientist who will show us how to grow hair on a bald man's head. It will probably have to be held in reserve for a great many years to come.

Medical men are apt to become pretty cocky when they contemplate the unquestioned triumphs of their science. Such successful forms of treatment as the administration of quinine in malaria, of salicin in gonorrhea, and of insulin in diabetes are achievements of which they may well be proud. But it is a source of great mortification to physicians that, while they can often bring a flailing heart up to par or cut off a diseased appendix out of the abdomen, they are fairly helpless in the presence of the shaggy hairiness dome. The bald head is the medical battlefield on which the doctor must inevitably meet his Waterloo.

The medical man does not know a great deal about baldness, it is true, but he knows a great deal more than the public. What the average person knows about baldness and its causes and proper treatment, if any, would make a comprehensive encyclopedia of misinformation, hence the present article.

In medical parlance, baldness is known as *alopecia*, but whether the condition is called by its Greek or English name, the hair falls out just the same. Various types have been described and given fantastic names by skin specialists. The hair loss may occur in patches, it may be the temporary result of some systemic disease which lowers the general vitality, such as typhoid fever or tuberculosis, or, in rare cases, it may be present at birth.

THE usual form of baldness, and the one in which we are chiefly interested, goes under the high-sounding designation of *anropathic premature alopecia*. The word "anropathic" has quite a dignified definition in the medical dictionary, but the truth of the matter is that it means nothing more than "cause unknown."

Some degree of baldness is by no means uncommon before the age of thirty, and it may be observed under twenty-five. Two brothers who once lived around the corner from me were as bald as the proverbial billiard ball before they were nineteen.

There is no question that bald heads, just like brown eyes, red hair, and many other tendencies, are prone to run in families. One might say



Hope Springs Eternal

"When hair is permitted to a bald man, he buys first and thinks last. Never. The stock supplies a new bald-headed sucker every five minutes."

that the baldness of the father is visited upon their children for generations to come. A good way to prevent baldness is to select a father with a strong crop of hair.

When baldness comes on in later years of life, the condition is accepted philosophically as one of the normal attributes of age, but when a young or a middle-aged man sees his hair hair receding, he gripply prepares to fight the loss of his hair to the last ounce of hair restorer.

The first bald spot picks its location with the accuracy of a sharpshooter. It makes its debut just back of the top of the head, in the exact terms of a mariner, we might say at 90° north latitude and right through the prime meridian of longitude. Soon afterward, the hair-line

By

FREDERIC DAMRAU, M.D.

on the forehead begins to recede. These two initial bald areas gradually extend until, in extreme cases, nothing is left but a narrow fringe of hair at the ears and back of the scalp.

Baldness does not ordinarily result from the sudden falling out of a large quantity of normal-sized hairs. The process is more gradual. As fast as the hair falls out it grows again, but each successive crop of hair is of finer texture, until finally the hair ceases to grow altogether. "Going, going, gone" does not express the true state of affairs. To be strictly accurate, the password for admission to the Alopecia Club should be, "Going and coming, going faster and coming slower, going but not coming, gone."

EACH individual hair arises from a narrow pit in the scalp known as a hair follicle. The follicle nourishes the hair from the hair grows in length by a gradual multiplication of the cells at the base of the pit. As every flapper who has her eyebrows tweezed knows, the hair will grow again so long as the follicle remains intact. If the hair follicle is destroyed, as is done for the permanent removal of superfluous hair, the hair will not grow again.

Sometimes, during severe illnesses, there is a wholesale shedding of the hair. This type of anropathic seldom gives rise to permanent baldness, for the hair follicles are not destroyed and an early growth of new hair may be expected. But once the hair follicles have really wasted away—as occurs in the common type of baldness in men, the prospect of growing hair again is about as hopeful as that of growing grass on a glass-topped desk.

The medical grab-bag is full of the earliest theories about the cause of baldness. Any writer who is satisfied with quoting an "eminent authority" as sufficient reason to sponsor any theory in particular can put his hand in the bag and draw out a perfectly plausible theory.

THE "derby hat theory"

of baldness had considerable vogue for many years. The conception was that the hat presses upon the arteries that nourish the scalp and thus gives rise to an undernourished state of the hair follicles, furthermore, the lack of free circulation of air under the hat was supposed to play some mysterious part in undermining the nutrition of the scalp. The answer to this explanation is that, long before the derby

Exploded Theories of Baldness

"THE medical grab-bag is full of discarded theories about the cause of baldness," says Doctor Damrau. Some of the most common of the exploded theories he lists as follows:

That the derby hat presses on the arteries that nourish the scalp, cutting off circulation.

That lack of air circulation under the hat plays some mysterious part in undermining the nutrition of the scalp.

That much brainwork pushes the hair out.

That dandruff makes the hair fall out by attacking and destroying the base by which the hair is nourished.

That ultraviolet light from the sun will cure baldness.

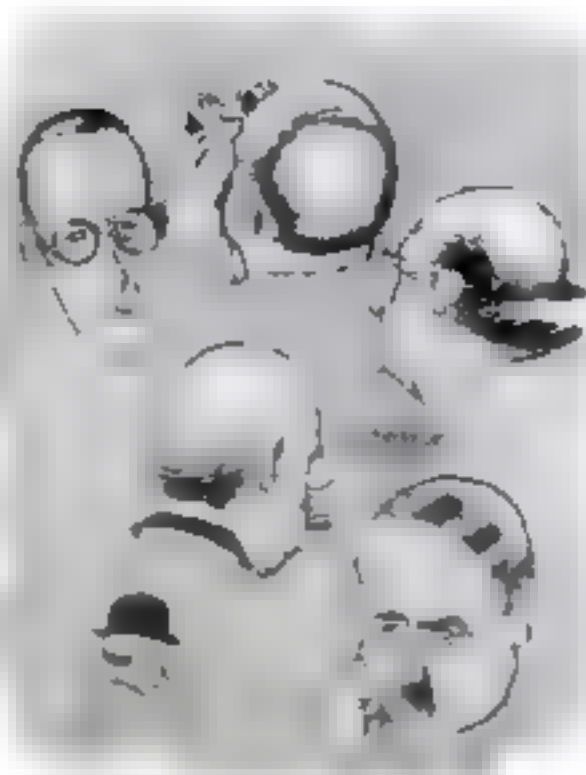
hat swam into our ken, the smooth, shiny dome was still quite the thing.

Another theory, which was possibly fostered by the egotism of some bald-headed men, held that alopecia is an affliction of the intellectual classes and that it results from excessive brainwork. This view is exceedingly grateful and consoling. The only trouble is that it has no basis in fact.

Dr. William Allen Pusey of Chicago, an American skin specialist of high repute, and a former president of the American Medical Association, holds that the fashion of going without hats, especially during the summer months, may be an exciting factor in causing baldness. He believes that the ultraviolet rays of the sun may, to some extent, unfavorably influence the nutrition of the hair follicles.

I HAVE a friend who, having been informed that ultraviolet light will cure baldness, reasoned that the summer sun is rich in these particular rays and should therefore check the loss of his hair. So he hired a bathhouse at the seashore for the summer and left all his straw hats home. But the only success he had was to get rid of what little hair remained.

Misanthropes say that only one person in ten has brains under his hat; the other nine have dandruff. In view of the fact that dandruff is so very common, it was inevitable that it should acquire the blame for baldness. Even in the latest textbooks on diseases of the skin, dandruff is still given as the most important cause of alopecia. Yet there are certain



Some Commonly Accepted Styles

"The first bald spot picks its location with the accuracy of a sharpshooter. It makes its debut just back of the top of the head. Soon afterward the hair line on the forehead begins to recede until, in extreme cases, nothing is left but a fringe of hair at the sides and back of the scalp."

undeniable facts, as will be shown presently, that greatly weaken the case against dandruff.

Some explanation as to the nature of dandruff is required. All dandruff is not alike. The fine white branny flakes simply represent skin scurf; they come from the outer horny layers of the skin, being composed essentially of horny cells

that have dried and separated from the parent substance. Another type of dandruff consists of rather large greasy scales, which, when closely examined, will be seen to have little holes for the passage of the hairs. This kind of dandruff is really dried skin oil (sebum) and is associated with an over-secretion of this substance.

The dandruff theory is that the disturbance responsible for the formation of dandruff gradually extends into the depth of the hair follicle, finally destroying the base by which the hair is nourished and from which it grows. Now it may be true that excessive dandruff plays some part in hastening the ravages of baldness, once the condition has begun. There is no question but the correct treatment of the scalp directed toward the disturbance which causes the dandruff will retard the encroaching spread of the bald spot; but it cannot prevent the ultimate outcome.

DANDRUFF has been so vehemently denounced by eminent authorities as the cause of baldness that it is about time that a few words be said in its defense. In the first place, dandruff is equally common among men and women, but baldness is very common among men and very uncommon among women. It has been urged that the reason for this disparity is to be found in the much greater care with which women attend to their scalp and hair. But any social worker can tell you that baldness is just as rare among certain classes of female marginals who

(Continued on page 145)

New Penmanship Makes Your Writing Readable

HOW good is your handwriting? Do you have a system all your own with flourishes, cranks and dashes that give your friends and business associates brain fever when they try to decipher what you pen? Perhaps a typewriter has come to your rescue.

For some time teachers, business executives, and in fact, almost everyone have realized that the number of really good writers has become exceedingly small. Among those who have suspected that the style of writing has something to do with it is Miss Frances M. Moore, a teacher in New York City with many years' experience as an instructor in penmanship. Not long ago she began introducing a new system imported from England called "broad-edge pen writing."

In appearance, this new penmanship looks like printing—each letter is made distinct and separate from every other.

Perhaps the greatest advantage of the new-old handwriting is the ease with which it may be learned. Besides the remarkable results which have been achieved in children's work, there is further very interesting evidence of this in the large number of people who have worked out for themselves a writing of this same type.

Easier than Script

Miss Frances M. Moore, New York school teacher, and a disciple of her ingenious new method of handwriting by which the letters are printed with a broad-pointed pen. It can be written rapidly and is easier than script, she says.

In the old days, monks used this kind of lettering in copying manuscripts by hand. Their beautiful products are admired universally.

Through actual tests made with her own pupils, Miss Moore has found that they can write this way as rapidly as when using the ordinary script. Miss Moore comments on the ease of the writing

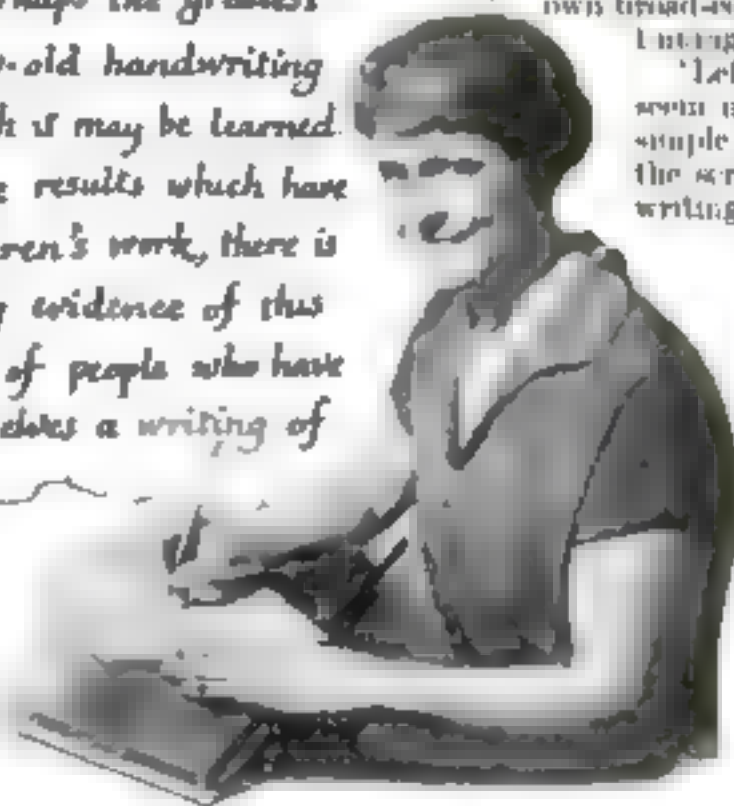
in a letter to POPULAR SCIENCE MONTHLY, part of which is reproduced with the accompanying photograph, to show a specimen of her own broad-edge pen writing. Concluding she writes:

"Left to ourselves, we seem naturally to adopt the simple letter forms used by the scribes in the days when writing, though even more important as a tool than in this age of printing presses, typewriters and adding machines, was yet looked upon as an art. We seem instinctively to appreciate the union in the old writing of the practical and the beautiful."

Children usually learn to print before they learn to write, and find

it easier than script. Some persons—Thomas A. Edison is one example—have worked out systems of printing all for themselves. All of which goes to show, Miss Moore contends, that printing is the natural mode of expression.

Under this system, a child learns only one alphabet—the printed one, and it is impossible for the writing to be scribbled.



A Bear Hunt 20,000 Years Ago



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IN PREHISTORIC deposits at Predmost, Czecho-Slovakia, Prof. D. K. Absolon of Prague University recently uncovered the bones of a number of Pleistocene cave bears, huge animals, that often reached a height of 12 feet, and that were much more formidable beasts than the American grizzly.

Our artist here shows the primitive men of the Ice Age attacking the cave bear. They began their attack by trapping the big beast in pitfalls. Then, armed with flint-tipped spears and darts, they slew the huge mammoth. The bones found at Predmost show our primitive ancestors were both bold and crafty.



Recent photograph of the giant Wilson Dam at Muscle Shoals, a unit in the Tennessee River super power project. The 18-mile lake formed by the dam may be seen directly above the structure. The navigation lock is in the foreground.

The Power of Five Niagaras

Tiny Drops of Water to Do the Work of 4,000,000 Horses

FIVE times as much power as can be generated by the great dynamos on the United States side of Niagara enough to convert the South, with its peaceful corn and cotton fields, into a humming industrial center, and to make of the Tennessee river valley in the southern Appalachian mountains, an American Ruhr.

A system of artificial lakes, and the deepening of the Tennessee river so that ships may travel from Knoxville through the Ohio and Mississippi rivers to the Gulf of Mexico. A ship canal from the Tennessee river to the Tombigbee river to give this vast new industrial country still another port at Mobile, Alabama.

All this is included in a breath-taking project announced recently by Major Harold C. Fiske of the U. S. Army, chief of the Tennessee Valley Power Survey. It has been called the most stupendous single engineering project in this generation. The plan is to build 100 dams on a 400-mile stretch of the Tennessee river between Paducah, Ky., and Knoxville, Tenn., conserving the heavy rainfall of this region. When all the dams are completed, it is estimated that they will be capable of generating, through combined power of



This map shows the location of the vast engineering project which is expected eventually to develop 4,000,000 horsepower from the Tennessee river between Paducah and Knoxville.

falling drops of water, the almost inconceivable total of 4,000,000 horsepower.

One thousand miners working diligently every day in the year for four years might be able to produce the six million tons of coal that would be required to generate such tremendous power.

THE South used to be called sleepy, leisurely, sometimes slow, perhaps because these adjectives fitted in with the life of a sunny agricultural land. The average American now can widen his eyes at a picture of this country as one of the greatest industrial centers in the world, with factories working day and night,

steel mills throwing showers of sparks into the air, and ships traveling to the sea carrying thousands of tons of manufactured products.

The War Department has been surveying the Tennessee valley region for the last five years. Army fliers have made thousands of pictures which, when pieced together, form detailed maps of this promising land of potential power. The flow of every little stream was estimated, and when all of the data was in, the officials learned that in this single valley in the south was concentrated 20 per cent of the entire potential hydroelectric power of the United States.



The powerhouse at Wilson Dam, with capacity for generating 100,000 horsepower. In the foreground is the weir which will measure the volume of water passing from the hydraulic turbines in the powerhouse.

The region through which the river winds is rich in natural resources. There are iron, copper, zinc, limestone and marble. And back of these timber lands and corn and cotton fields—everything needed to support rich industrial cities which, it is predicted, will spring up as soon as the power of the great river is harnessed.

Four utility companies already have made applications to the Government to build dams on the river, and 24 of the dams now will be under construction. The best known dams now on the river are the Muscle Shoals Dam. One of these, the Wilson Dam, begun by the Government during the war to supply electrical power to take nitrates from the air, is virtually completed. It is one of the most magnificent engineering achievements in the country. Fifty-eight gates regulate the flow, from a gentle flood to a roaring torrent. Two great navigation locks 300 feet in length operate like clockwork.

Eight generators now are being installed, but the powerhouse is big enough so that ten more generators may be added when the dams higher up on the stream are completed. With these all working, it is estimated that even at the lowest water stage, Muscle Shoals will be able to produce 100,000 horsepower.

Every dam that is thrown across the river above Muscle Shoals, of course, gives more control of the water at the Wilson Dam. One of the proposed dams, above the Cove Creek Dam, during low water season will double the power at Muscle Shoals. This dam will be 200 feet high and form an artificial lake 80 miles long. The huge lake now formed by the Wilson Dam, 15 miles from shore to shore,

and surrounded by wooded hills, looks as if nature itself had planted it in the Appalachians. When the dams are completed, a chain of picturesque lakes will stretch across Tennessee. In this case, industry rather than making the country ugly, will beautify it. In addition a national park will be created in this region,

Huge Navigation Lock

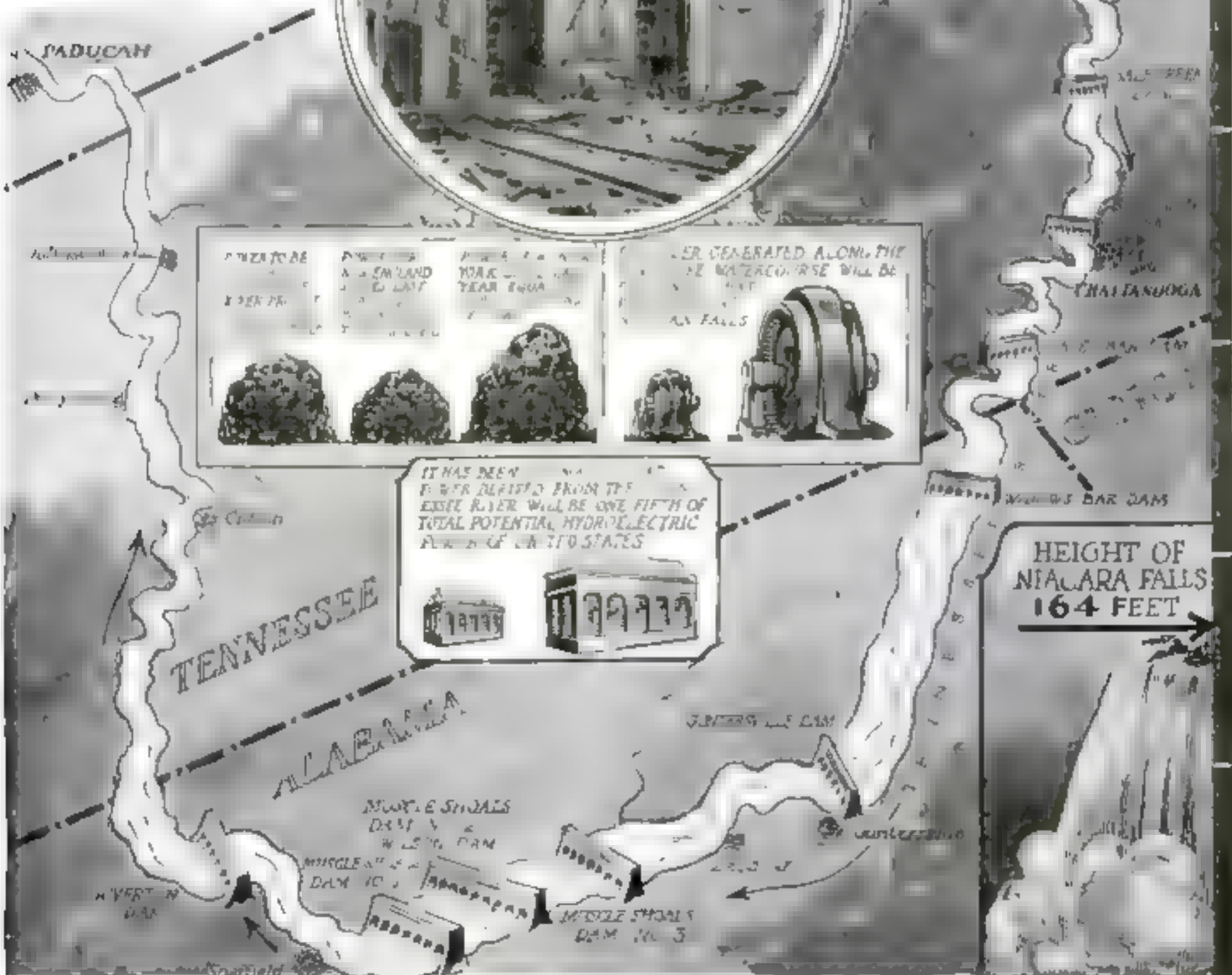
At the right. A giant crane at work on the double lift lock at Wilson Dam. The new lock will be 100 feet long and will permit navigation of the Tennessee River.



IT HAS BEEN ESTIMATED THAT THE POWER GENERATED FROM THE ENTIRE RIVER WILL BE ONE FIFTH OF TOTAL POTENTIAL HYDRO-ELECTRIC POWER OF THE UNITED STATES



HEIGHT OF NIAGARA FALLS
164 FEET



Map of the proposed super power development of the Tennessee river showing location of projected dams. In the completed project there would be 150 dams producing 4,000,000 horsepower. The

total fall of the river, including all dams, would be virtually five times that of Niagara. In the insets are graphic comparisons giving an idea of the tremendous possibilities for useful power

Five New Ways to Test the Power of Your Mind

Try These Brain Teasers and Measure Your Abilities

HERE are five new ways to measure the power of your mind—five fascinating methods of obtaining an index to your talents and capabilities.

They form the second group of the remarkable series of scientific tests arranged for the readers of *POPULAR SCIENCE MONTHLY* by Dr. Albert Johnson, of the Department of Psychology, Columbia University, according to the principles utilized by eminent scientists in measuring intelligence and supplying vocational guidance.

By means of these tests you can tell in a few minutes in just what directions your mind works best, and where lies the work that is most likely to bring you success.

Last month Dr. Johnson offered five tests designed to measure your ingenuity, your imagination, your sense of form and your mechanical skill, your ability to work with numbers, and your sharpness of perception.

This month he offers tests of the co-ordination of your mind and muscles, of your power of concentration, of the elasticity of your mind, of your adaptability, and a new test of your mathematical talent.

Each test offers an interesting problem which you must solve. The solutions are printed on page 146 and with the solu-



Does Your Mind Fully Control Your Muscles?



Cut out this star, and insert in a cardboard box from which the bottom has been removed and place before a mirror as shown above. Looking in the mirror, trace the outline of the star with a pencil between the double lines. If you cross the lines, return to the blank space and continue. Note carefully the time it takes you to make the entire circuit of the star.

tions is given a system of scoring that tells whether you have shown superior, average or inferior ability in performing the tests.

In fairness to yourself, though, do not look at the solutions until after you have completed all tests.

The first test, performed with the star shown at the right above, is a test of

co-ordination. Do your muscles obey the dictates of your mind? Are they fully under its control? Can you learn quickly a difficult new process such as driving an automobile, operating a machine, or playing a game? This test will tell you in a few seconds.

Can you concentrate? Can you detect errors rapidly and surely? Try the test

Test Your Concentration

SOME of the answers to the simple examples in addition and subtraction given below are incorrect. The object of this test of concentration is to detect the errors. Work until you have found all the mistakes; then, when you have completed all tests, turn to page 146 for your rating.

$3 + 12 = 15$	$6 + 15 = 22$
$13 + 3 = 10$	$12 - 7 = 5$
$16 - 9 = 7$	$19 - 6 = 13$
$12 - 6 = 6$	$16 + 6 = 22$
$15 - 2 = 13$	$14 + 9 = 23$
$15 + 5 = 10$	$11 + 4 = 14$
$5 + 17 = 22$	$16 + 4 = 22$
$4 + 18 = 22$	$13 - 4 = 9$
$16 - 5 = 11$	$13 - 2 = 11$
$17 + 7 = 23$	$15 - 4 = 11$
$14 - 8 = 6$	$12 + 4 = 16$
$18 - 4 = 12$	$12 - 9 = 3$
$14 + 6 = 20$	$2 + 11 = 13$
$15 - 8 = 7$	$18 - 8 = 10$
$16 + 8 = 23$	$19 - 7 = 13$
$19 + 9 = 28$	$5 + 13 = 18$
$15 + 9 = 25$	$13 - 5 = 8$
$19 + 5 = 24$	$16 - 2 = 13$
$14 - 9 = 5$	$12 + 9 = 21$
$7 + 18 = 25$	$9 + 7 = 17$

How Agile Is Your Mind?

EACH of the English proverbs in the first list below has a corresponding African proverb somewhere in the second list, that is, a proverb that is worded differently but whose sense is the same. In the blank space beside each English proverb write the number of the African proverb which most nearly has the same meaning. Work for exactly five minutes.

ENGLISH PROVERBS

- Murder in haste we repent at leisure.
- Answer a fool according to his folly.
- One swallow does not make a summer.
- Out of the frying-pan into the fire.
- Robbing Peter to pay Paul.
- Birds of a feather flock together.
- First catch your hare.
- Sour grapes.
- Adding insult to injury.
- Curses come home to roost.
- Distance lends enchantment.
- Milk for babes.
- We can all endure the misfortunes of others.

AFRICAN PROVERBS

- One tree does not make a forest.
- I nearly killed the bird. No one can eat nearly in a stew.
- Full belly child says to hungry-belly child, "Keep good cheer."
- Distant firewood is good firewood.
- Ashes fly in the face of him who throws them.
- If the boy says he wants to tie the water with a string, ask him if he means the water in the pot or the water in the lagoon.
- Cocunut is not good for birds to eat.
- He runs away from the sword and hides himself in the scabbard.
- A fool of Ika and an idiot of Iluka meet together to make friends.
- The ground-pig said, "I do not feel so angry with the man who killed me as with the man who dashed me on the ground after."
- Quick loving a woman means quick not loving a woman.
- If the stomach is not strong, do not eat cockroaches.
- No one should draw water from the spring to supply the river.

at the lower left-hand corner of this same page, and discover these important facts about yourself.

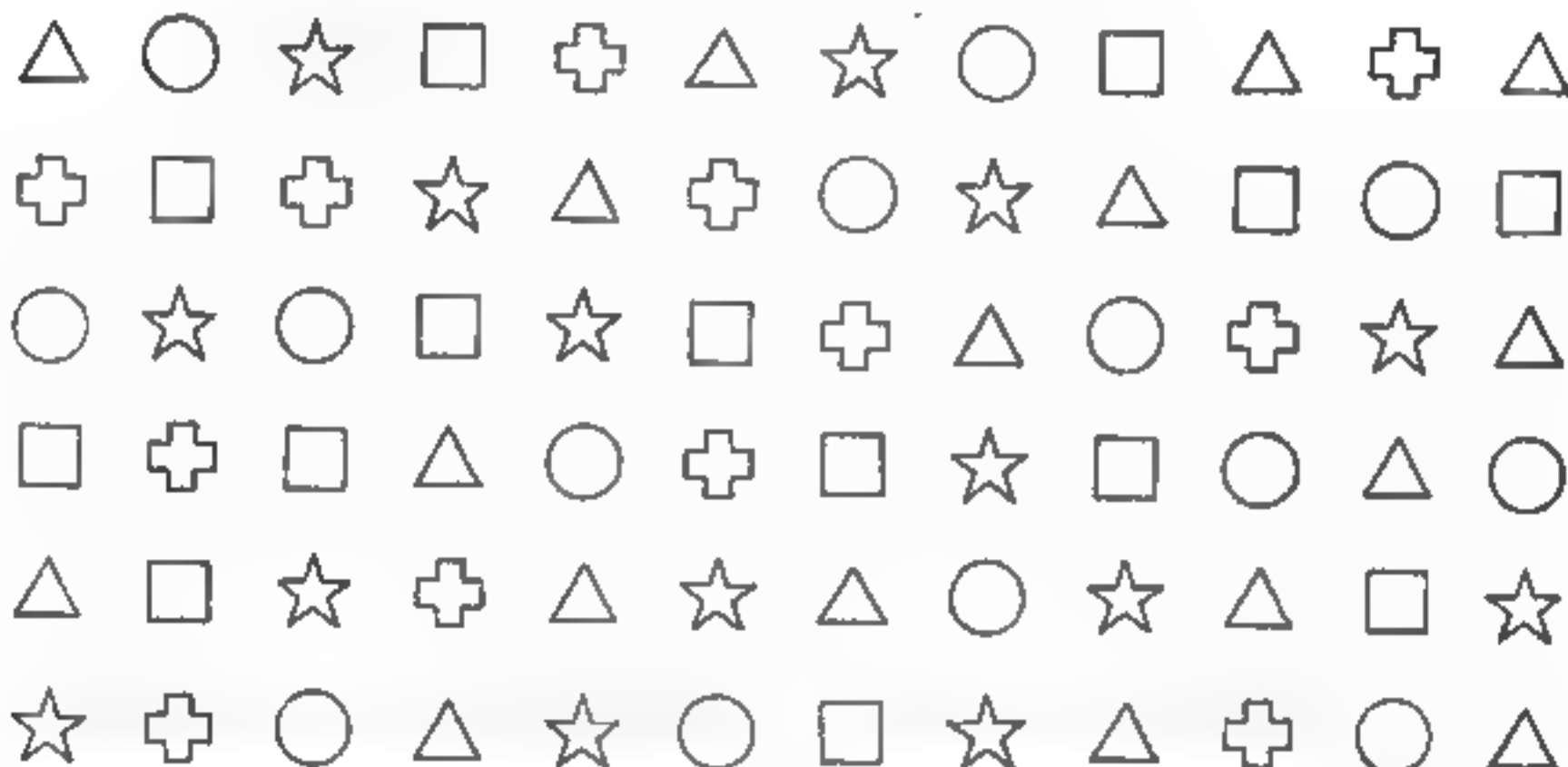
Do you form new associations easily? Can you learn a foreign language, or the details of a new occupation? The proverb test at the other side of the same page will supply the answers to those questions.

Are you adaptable? Is your memory good? Do you learn quickly, especially in regard to form? Would you, for example, be likely to succeed as a hotel man because you can remember faces? Or would you be able to remember the location of the stock in a large store? The symbol test just below will quickly

indicate your talents in these directions.

Somewhat similar in its purpose to this test and the previous one is the code test at the lower left-hand corner of this page. Try this test, obeying faithfully the rules, then pass on to the next test, in the right hand corner, which is a measure of your mathematical ability.

Is Your Memory Good, and How Rapidly Do You Learn?



Study the five symbols at the top until you feel sure you know what number each contains. Note the time. Then write down

each symbol below the appropriate letter—in each star a 1 and so on. When you have finished, note how long it took you

See How Quickly You Can Do This One

1 2 3 4 5 6 7 8 9 0
C J L S T U V X Z O

ABOVE are ten letters, each of which is indicated by one of the ten digits. Learn which number stands for each letter, then, timing yourself write in the blank spaces below the proper numbers for each set of letters as indicated in the first two sets, which already are filled in. Work until you have finished, and make note of your time.

C Z J T	1 9 2 5	T V J L			S O C J		
J O V S	2 0 7 4	J O C X			L Z J Z		
T V L O		U C V T			V L X S		
C X T O		S O J Z			T Z C O		
V U O S		T X L X			Z J T O		
J S U L		S C S Z			X O T J		
Z S Z C		V X J X			U V C X		
X L T U		U J C L			T X T L		
V U C O		S V T O			S V U V		
J U X L		U L C S			Z U O S		
Z C Z U		J Z T V			L Z T V		
U Z L O		L U J O			S X C U		

Are You Good at Numbers?

IN each row of numbers below I write on the two dotted lines the numbers that should come next to complete the series, as for example 2 4 6 8 10 12 14 16. Work for three minutes, then stop and turn to page 146 for your rating in all tests.

2	4	6	8	10	12	14	16
2	3	4	5	6	7		
10	9	8	7	6	5		
5	10	15	20	25	30		
6	9	12	15	18	21		
8	8	6	6	4	4		
3	7	11	15	19	23		
9	1	7	1	5	1		
4	5	6	9	12	13		
25	25	21	21	17	17		
1	2	4	8	16	32		
21	18	16	13	11	8		
12	14	13	15	14	16		
16	12	15	11	14	10		
25	24	22	21	19	18		
16	8	4	2	1	1		
3	4	6	9	13	18		
1	4	9	16	25	36		
15	16	14	17	13	18		
21	18	16	15	12	10		
4	8	10	20	22	44		

Mistakes I Made When I Built My House

*Why my floors creak
and floods threaten
the basement—How
I almost asphyxiated
my family—Pitfalls
that you can avoid*

By JOHN R. McMAHON

"The House that Junk Built"

A side view of Mr. McMahon's home, showing the full-size garage in which he says he realized all his ambitions for perfect construction, in which he did not quite achieve in his dwelling. This garage is entirely fireproof as well as convenient.

TWELVE years ago I built a house, and entwined about it some magazine articles and a book called *The House that Junk Built*.

Now I shall make that house confess its secret sins, open its doors to the world, expose the skeletons in its secret closets, tell how it might have been a better house if the amateur builder had not forced it to take the first wrong step, in short, inform and warn others of the more or less hideous pitfalls that await an innocent little home-schemer's domicile which rambles down the corridors of time.

It is a proverb that the amateur's first house is too small, his second too large, and his third just right. That's my defense, if I need one. I have done only the first. Yet with only one life to live, I don't know what I could do with two more houses. The present dwelling shelters me pretty satisfactorily. My family is used to it. Our two dogs like it. Having made our abode here for one decade, we may as well keep right on, while amusing ourselves from time to time, with it-might-have-beens.

We amateur builders who, according to the last census, are almost as numerous as inventors, ought to coalesce in a fraternal society with an annual outing and games at Atlantic City or Coronado Beach. We could draw on the sand our home designs, even build little



With All Its Faults, a Real Home

Even though the floors may creak, the writer's home, he says, "shelters me pretty satisfactorily." Here is the comfortable living room, with a broad fireplace flanked by shelves of books.

sand models of our dwellings, and fraternally compare their merits, having enough policemen on hand to avert homicide. How the sand would fly! We old builders would unobscure to each other, boast of

low costs, and tell how much we did with our naked hands. If a professional architect intruded upon us, we would probably lynch him—unless he admitted that our models were meritorious.

WHO has the right to call himself an amateur builder? Not the person who merely squabbles with a hired architect, and reprimands a painter for slapping on the wrong color. Such fencers have no place in our ranks. The genuine amateur is his own architect, biding not more than half his ideas from professional sources. There should be gaps in

his plans, allowing for happy inspiration or misfortune. He is his own contractor and engineer. He buys his own material, hires and fires labor at day's wages. He is his own foreman. He should work on the job himself at least half the time and in such activity the logic of his inexperience usually gives him the status of common laborer or apprentice to his staff of skilled mechanics. Thus the owner at one moment voices a sharp order to his mason employee and the next moment the mason retaliates by snapping at the boss, "More mort!" Neither one dares to go too far with the other. It is ideal. My men and I used to enjoy calling each other down.

"The House that Junk Built" puts me in a fix. I must confess that either the title or the house is "off." I exonerate the house, which deserves no such stigma, and

Don't Miss This Unusual Series

THIS is the first of a remarkable new series of helpful and entertaining articles on home building by one of the country's recognized authorities on the subject.

From his own experience, Mr. McMahon describes here some of the errors and pitfalls into which the amateur builder is likely to fall. In subsequent articles he will explain, in detail, points about home ownership that you have wanted to know. Whether you're planning a house of your own or not, you'll be interested in what he has to say about such problems as designing a home, supervising its construction, making alterations or additions, and keeping it in good repair. In the dozens of little "kinks" he suggests, you'll find much of practical value.

Watch for the second article of Mr. McMahon's unusual series in next month's issue.

admit a slight deception in the title for drawing purposes. The so-called junk is merely a quota of second-hand building material, most of it equal to new. I have found, like others, that bargains should be studied for a week before purchase. Not because of hidden inferiority but because the labor cost of adaptation often outruns the saving. Junk is a temptation. Unless you have estimated closely its use—whether it's lumber, bricks or steel—avoid the bargain.

THE junk in our house that I most regret consists of floor beams. They came from a bridge. Strong? They would uphold a freight car, being 8 by 10, long leaf pine, on walls or steel girders of 8-foot span. Yet I spaced them too widely for a creakless floor. Their principal fault is esthetic, to an observer who stands in the north end of the basement and looks up. He then sees the sides of those bridge planks scuffed by innumerable hoofs, and he can almost hear the hollow thudding klunk of steeds that used to race over the river. I wish those planks were more tidy. I would cover them with a ceiling, only the exposed beams are too useful for hanging up tools besides affording the advantage of accessible plumbing, water pipes and electric cables.

Floor joists should be 2 by 10 inches, spaced on 16-inch centers, with diagonal braces or "bridging" every eight feet or so. Then it's well to have a subfloor—which we haven't—of common boards beneath the top wearing surface. This makes for warmth and rigidity. A frame house is extra softened throughout when the subfloor is laid diagonally. But it is never too late to mend, at least partially, and you can always put a new top floor on what you have.

I scorned the superficial when I built. Not looks but strength was my motto. Time has mellowed that point of view and I am now willing to concede that those artist friends who hinted at the ugliness of rock-faced concrete blocks meant to do me a service. Today Nature and a daughter of her who invented aprons have amended the rugged quality of our walls with robes of green and

He Is His Own Mechanic



Mr. McMahon, at work on the electric pump in the basement of his home—this was not part of the junk that built his home

festoons of flowers. Our house's crude strength is dolled up, even perfumed in due season. 'Tis well—but when intelligent visitors come, I lead them to the basement and have them, so to speak, feel of the muscles of our house. They generally say "Oh, my!" at our two steel girders, and a few of them understand the excellent masonry of the walls.

Here a cardinal confession. I lacked supreme faith when I built. I risked my all—but I should have gambled further with my neighbors, or at least the building-and-loan's wealth. I had the vision of a perfect house, entirely fireproof. Through shortage of funds I compromised on wooden floors, partitions and roof. It was cowardice. I pretended that I did not care to be in debt. I was too proud to borrow. For the rest of my days, this semi-fireproof house will sneer at my chicken-heartedness. If we had gone in debt, we could have wiped it out a few years after the event. We could not have lost on a better house even if our circumstances had not improved. At worst, in a forced sale, a better house returns more proceeds.

My Twelve Worst Mistakes

1. Lack of nerve to borrow money so as to build a better house
2. Spacing floor joists too far apart. My floor will support a freight car, yet it creaks.
3. Failure to provide a subfloor, for warmth and rigidity
4. Neglect of outside drainage problem.
5. No overflow vent for cistern
6. No cinder base under concrete floor in basement. Failed to use level in building the floor
7. Did not plan for screening and glassing sleeping porch
8. Lack of ash dump for open fireplace.
9. No outside filler for the ice chest
10. Fruit shelves, attached to wooden plugs in wall, collapsed, with great mortality of glass-canned tomatoes.
11. Shy of closet room—of course
12. Almost asphyxiated my family by labyrinth of pipes that filled house with exhaust from the gas engine.

STILL and all, I do not lie awake nights bemoaning my prudence and lack of genius to advocate greatly. I know my limitations. If I had borrowed, I would have died five or six days, worrying about the mortgage. Let those who are braver cast the first stone and take larger chances. I proclaim my weakness, at a egg or young amateurs to spend enough money on their dwelling. This is not advice to splurge on the decorative but to spend with judicious liberality on essentials.

My next imaginary house will have outer walls of smooth-faced concrete blocks, stone, brick or hollow tile. The partition walls must be gypsum block or hollow tile or concrete on metal lath. The floors will be hollow tile. The roof outdoors metal covered with concrete slabs or tile, mayhap strigies of rigid asbestos or of copper. Our present roofing of asbestos on asphalt has all the characteristics of a gold-plated wedding ring. It has exceeded its ten-year guarantee but can never become an heirloom.



Rugged Ugliness. "Not looks but strength was my motto. Time has mellowed that point of view. Those artist friends who hinted at the ugliness of rock-faced concrete blocks meant to do me a service."



Clothed by Nature. "Today Nature and a daughter of her who invented aprons have amended the rugged noddy of our walls with robes of green and festoons of flowers, and dolled-up our house's crude strength."

Every other amateur builder who has from three to thirty thousand to spend, devises a great and original economy. You have guessed it. He omits the cellar, thereby saving heaps of cash. The inventor boasts of his discovery the first year; he is almost as proud of no cellar as a six-year-old is of a lost tooth. He is sorry for the unfortunates who have sunk money in a useless hole. There is less talk the second year. Deep silence the third winter. And in the fourth summer season passers-by notice a pair of human moles burrowing under that house and piling dirt high on the lawn. "Yes, we are having a cellar dug," admits the owner.

IT COSTS more to have it done that way, and more yet if the house then has to be raised for higher foundation walls. Just to increase trouble along these lines, a certain amateur built a cellarless house on the wrong site, had it moved to the right place and then had a team of moles carve a cellar under shelter of the donnade.

These are real cases, even to the thirty thousand example. The moral is that no house, except in desert or semi-tropical country, should be put up without a cellar. On this point the Italian laborer in our land is better informed than many Americans: he, the mole, laughs gayly as he digs under the fool boss's house; his own humble shack has an excellent sub-story of solid, watertight concrete, and it was made in the beginning. Ask Louis and Joe about this.

Naturally, our house can draw up its self-righteous skirts and declare that it never dreamed of starting life without a cellar, or its equivalent, which is a basement. That basement has as much area as the living floor above. It is a wonderful workshop and storage space, gives room for furnace, lighting plant, ice chest, has a large fruit-and-vegetable division, and an ample separate space for ladders, window screens, and garden tools.

"House, you are boastful. I have seen three inches of water in that model basement; a little more would have spelled calamity, for with the furnace put out in midwinter the pipes would have frozen and we folks frozen too."

MY HOUSE retorts, icily, that this was no fault of its own: the problem was one of outside grading and drainage. A fair excuse, shifting the blame onto an unintelligent owner. I am reminded by the episode how amateur builders ever tread the marge of tragedy and often escape by the skin of their teeth. A broken window pane in ten-below-zero weather ruined a suburban family. One fatal thing led to another, the folks had to move out, the place was sold for a song on a plumber's lien.

I made our main basement floor entirely by myself, mixing the concrete outdoors, hauling it in on a wheelbarrow, dumping the stuff and spreading it with a trowel. It's about three inches thick,



"Friend Wife" Delights in a Good Basement

Here is Mrs. McMahon, tending the furnace in the model basement, which provides ample room for a wonderful workshop, storage space, heating and lighting plants, ice chest, and a fruit and vegetable division.

solid enough, but lacks the benefit of line, level and straightedge. (I honestly didn't know then about the use of these methods to secure uniformity of surface.) It also lacks the advantage of a rich top surface above a concrete base. The material is the same all through. Worst of all, it has no six-inch layer of tamped cinders beneath but lies right on a clay bottom. It is sheer luck of the site that the floor is not wet in rainy weather. It merely sweats a little with condensation of moisture in summer, when warm air meets a surface in direct contact with cold clay.

The basement floor, furthermore, has no regular drain such as all ground floors should possess. But again chance has favored us with an accidental drain which consists of the stone sub-foundations of the house walls. It is safer not to depend so much on Lady Luck.

Among our defects is no ash-dump for the open fireplace. Half an hour's work at the right time would have saved me two days of labor upon a makeshift.



Well with Electric Pump

At first the well was equipped with a hand pump, shown above. Now Mr. McMahon has installed an electric pump and has covered the whole outfit with a strong concrete top.

Another fault, laboriously corrected, was due to having confidence in a mason's judgment as to the distance between firebrick and wood. What the mason regards as safe should be multiplied by two, then you will have less to worry about.

DOUBTLESS my stupidest bolchery concerns our cistern, which is in the basement and quite ingeniously built above a well. Exhausted by the feat of so placing a cistern, it never occurred to me to give it an outlet. As Archimedes once observed, "What enters must equally exit." He was right. The darn thing periodically overflows. Someone screeches, someone dashes bareheaded into the rain to shut off the diugus at the corner of the house. Then to sweep

away the mess of surplus moisture into basement drains. It's hateful, even while I marvel at the hydraulic lesson of a weighty concrete manhole cover flung upward by the might of water.

I have put in days drilling concrete inside and digging earth outside in the effort to give that wretched cistern a vent. So far I have been baffled by an unfavorable grade and, more lately, intimidated by an incidental consequence of my toil.

I had developed a maze of outer and inner pipes serving roof water, ice chest, cistern, and exhaust from the gas engine of the electric light plant. These pipes were so interconnected that only a mathematician could have understood their exact relations and foreseen the possibilities. Thus civilization, 'tis said, becomes lost in its own labyrinth. Be that as it may, while the electric light engine was running, I noticed that our cat, Horace, lay in a faint with extended legs. Our bull terrier tottered about glassy-eyed and became searick. Other members of the family were pleasantly drowsy. Five minutes more of those insidious fumes from the engine exhaust permeating the basement and rising to the living quarters would have painlessly finished the occupants of the dwelling. We opened everything, stopped the engine that was in cahoots with the pipe system to destroy us, and had headaches for half a day.

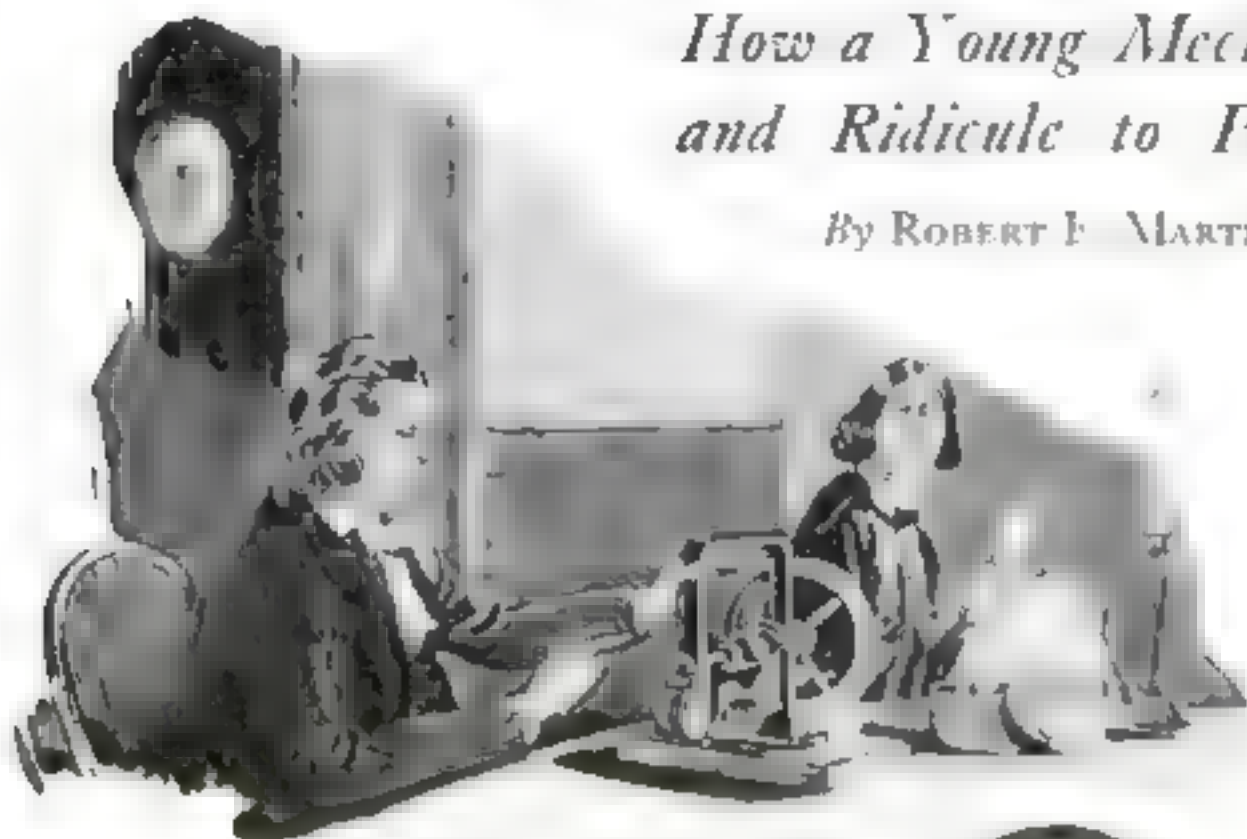
WHEN building our sleeping porch, there was lack of foresight to provide for screens and for glassed sash. The coping wall received a uniform outward slope, but the inner edge should have been flat or level to avoid beveling sash later. A little wire mesh reinforcement in the concrete coping would have prevented cracks. Some scheme for fastening screens and sash should have been devised in advance. Especially troublesome were the porch's round pillars. To fit against their curves, strips had to be carved laboriously and even profanely, and in the end we had to box the pillars in to give a square edge for sash. As for the abnormal size of our porch screens—some of them being 5 by 8 feet—I am reluctant to admit real

(Continued on page 33)

He Freed Women from Drudgery

How a Young Mechanic Battled Poverty and Ridicule to Perfect a Great Idea

By ROBERT F. MARTIN



Born of Necessity

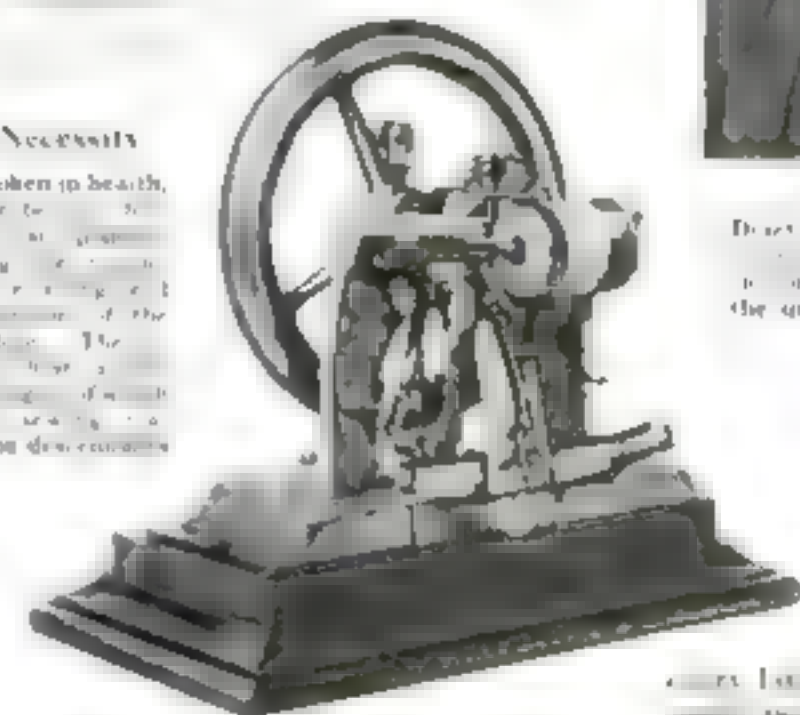
As Howe, broken in health, saw that a sewing machine was needed, he set to work to perfect it for the convenience of the sewing machine. The sewing machine was a great improvement on the old-fashioned sewing machine, and it was the first of the modern sewing machines.

IN A back alley in Boston a hundred years or so ago, a man named Art Davis rented a small shop, installed a few tools and machines, and hung out a shingle evoking for time and the sage word "mechanic."

Today we would call Davis a handyman, possibly even a jack-of-all trades, for he worked paint brush or hammer, fire or steel with equal means and equal force. A small little what was the pattern of the past was asked to do provided his patron was willing to pay for it.

At that time, though, and in that particular community, Davis was regarded as little less than a genius. For the people of Boston then had but two interests—literature and commerce. They had not yet perceived the first faint streaks of the new mechanical age that was about to dawn. It seemed wonderful to them that one ingenious Yankee could almost instantly diagnose and cure the ailments of a stopped clock or errant watch; reset the lenses in a telescope or surveyor's transit; open a door whose key was lost and with a few strokes of a file produce a new key; sharpen knives and skates, solder leaking pots and pans, repair broken firearms and perform whatever other services might be necessary in maintaining the efficiency of the few mechanical appliances that were in general use in that day.

AND SO Davis' fame grew apace. He became celebrated as a man who knew all there was to know about all mechanical matters. A flock of eager young men—inventors, seeking the road to recognition and wealth that had been opened up by the call for machinery for the rapidly growing industries of the nation—thronged the Davis shop to offer for his inspection the models of their in-



ventions. To obtain his advice and opinion with regard to the ideas for inventions they had conceived.

Into Davis' shop one day in 1817 came a youth of 18, a small thin, delicate-appearing lad, rather shabby and awkward—a country boy—the shrewd Davis guessed immediately. There was something about his young visitor, however, that intrigued Davis' interest, an odd air of dignity, almost of distinction, that caused the mechanic to forget the other's youth, rough clothing, and almost sickly appearance and to greet him with respect.

"You have an invention to show me?" he inquired.

"No, sir," answered the boy. "I am looking for work."

Davis hesitated. The rush of work that had come to his shop in recent years had necessitated his engaging a staff of helpers. Just then, though, there was no vacancy, certainly none for a young untrained apprentice such as this applicant appeared to be. And yet that vague but compelling quality that he had noticed in the personality of his caller prevented Davis from sending him away.

"I might have something for you," said the mechanic slowly, and as he uttered the words he was the unwitting spokesman of Fate.



A Real Hero of Invention

Driven by poverty, sickness, ridicule and scorn, Elias Howe fought an heroic battle for his idea and lived to perfect one of the useful inventions of the modern world.

For the ungainly but manly and engaging youth who stood before him was Elias Howe, destined within a few short years to invent and perfect the sewing machine, the wondrous contrivance that freed millions of women in

every land from the thralldom of toil and made possible the amazing variety and cheapness of modern clothing and virtually all other textile products. The device was one of all those developed in the golden age of invention that began with the first seven centuries and possibly most useful in the life of every human being.

BECAUSE, strange though it may seem, had Davis sent young Howe away that day, the latter might never have invented the sewing machine. It was in Davis' shop that the idea for the machine occurred to him, or rather was thrust upon him. It was in Davis' shop that he acquired most of the skill with tools that enabled him to fashion and assemble the intricate parts of his first machine. It was in Davis' shop, while performing the amazing variety of mechanical tasks for which his proprietor contracted that young Howe learned resourcefulness, developed his ingenuity and caught the handyman's knack of making whatever materials and tools he had around serve for the job he had to do.

Chance, then, played a conspicuous part in the invention of the sewing machine. Possibly chance may be accorded the leading role, though it was by no means the whole show. There were other elements that make the story of this invention one of the most thrilling and dramatic ever.

enacted. In all history no man ever waged a longer and more heroic fight than did Elias Howe in developing the sewing machine from a hazy suggestion casually offered one day in Davis' shop to a working, useful device, foolproof and efficient, capable of being operated by the most dull-witted seamstress.

AND the fight that he fought loses nothing in that it was spiritual and mental rather than an actual physical conflict. For the forces that opposed him were the mighty ones that try and sometimes destroy the soul of man—poverty, sickness, ridicule, neglect, discouragement, injustice, and enmity. His struggle against them supplies a chronicle that is inspiring, epic even. He triumphed and yet his triumph was but half a victory for in the struggle he lost much that was dear to him, and an unsuspected ally of his enemies—death—snatched the fruits of conquest from his hand almost at the moment he obtained them.

When young Howe told Ari Davis that he was the son of a farmer and an lee of Spencer, Mass., hence accustomed since childhood to working with the rude agricultural and grinding machinery of that day, the mechanic was glad that he had not offered him the brusque dismissal which he habitually accorded to applicants for jobs in his shop. When the boy added that he had had two years' actual experience with industrial machinery as a hand in a cotton machinery factory at Lowell and more recently as a hemp carter in a machine shop in Cambridge, after the panic of 1837 had closed the Lowell industries—he waited to hear no more, but engaged the boy immediately as a helper, and set him to doing simple repair work.

Quickly he found that he had made no

Where Women Slaves Become Masters



In almost every corner of the world today the sewing machine has come to free women from thralldom of drudgery and long cheerless hours—even in this little primitive African village where two of the native women are seen making the strange machine do their sewing for them.

mistake in engaging young Howe. There were better mechanics in his shop, specialists in one line of work or another, but Howe was a lad after his own stamp—a natural-born handyman, who with the same tools and with equal enthusiasm could put a new spring into a broken clock or a new trigger into a damaged gun. Moreover, the lack of coaxing which had of necessity accompanied his upbringing as one of a family of ten on a rocky, all but barren farm, had taught him to shift for himself virtually from infancy. He was self-reliant, confident of his own way of doing things. When Davis gave him a job, he never wasted his employer's time by inquiring how he wanted the thing done. He did it according to his own lights and by his own methods—and invariably the results pleased both Davis and his customers.

It was only a few months after Elias Howe joined Davis' staff of workmen that there entered the shop one day a man with a large bundle which he carried most carefully, as though it contained something precious. Removing the wrappings, the man drew out an elaborate contrivance of wood, a triumph of the whittler's art. Moving a lever at its base back and forth, he set into motion the weird assortment of cogs, wheels and driving rods that composed it.

"What is it?" inquired Davis with the suspicion of an amused smile.

"A knitting machine," answered the visitor mysteriously. "It's just what the cotton and woolen mills need."

Davis was an adept at getting rid of enthusiastic callers bearing inventions whose commercial possibilities to his practiced eye seemed negligible.

"You're mistaken," he told the man bluntly. "You're wasting your time. Why don't you occupy yourself with something useful—a—sewing machine, for example?"

"That's impossible," cried the man.

NOT at all," responded Davis easily. "Why, I could invent a sewing machine myself—if I only had the time to devote to it. Why don't you try it? It will certainly make your fortune. I'll be glad to examine it when you've completed it."

The visitor departed, promising to carry out Davis' suggestion. The latter, guessing at the success of his subterfuge, returned to his work.

His older workmen, used to their employer's ways, laughed with him. One occupant of the shop, though, saw no humor in what Davis had said. The words "sewing machine" had sunk deeply into young

(Continued on page 142)

A Million Dollars' Worth of Motor Cars at a Glance



How would you visualize a million dollars? Children try to do it by imagining counting goldpieces in a heap as big as a haystack. There is an easier way. Go any place where automobiles are parked row after row, as far as the eye

can see, and there is the million dollars. The remarkable panorama of wealth shown above was taken at Rockingham Speedway, N. H., and gives fair indication that the Granite State is well supplied with automobiles of every make

Do Athletes Die Young?

Careers of famous stars in boxing, football, baseball, rowing, tennis and track tend to show that the man who engages in strenuous sport has as good a chance for long life as anybody. The "athletic heart" bugaboo—When it's time to let up

By ARTHUR GRAHAME

IS THE path of athletic glory a short cut to the grave? Are the star athletes of today, in the pride of their youthful strength, placing on their marvelous bodies strains that will leave those bodies easy prey for the ills of middle-aged tomorrow? Do athletes die young?

Even the man who is not especially interested in sports is likely to ask himself these questions when he reads in his newspaper of the death at an early age—or even at a comparatively early age—of some famed athlete. To the man who has taken an active part in sport, such news has something of the warning character of the handwriting on the wall, and comes with the force of a real and personal shock.

Shocks of this kind have been frequent in the past 19 months.

Death has come to several famous athletes in their comparatively latest years in the drama of sport. Football has lost Walter Carr, and Percy D. thought he at 40, both by heart disease. To the famous pitcher, at 45, was

Frank Chance, the "Peerless Leader" of the champion Chicago Cubs of twenty years ago, died at 47 as the result of a general breakdown following an operation. Bright's disease killed Robert D. Wrenn, tennis champion in 1898 and 1897, at 32, and Billy Moske, prominent pugilist, at 30. Heart disease cut short at 34 the busy and picturesque career of Ralph D. Paine, Yale oarsman and football player, war correspondent and fiction writer, and the same disease ended, at 45, the life of Myer Prinstein, winner of Olympic events in 1900, 1904 and 1906, and one-time holder of the world's broad-jump record. Many other athletes and ex-athletes, almost as well known, have followed these stalwarts down the one-way trail.

Reading of these untimely deaths. The question arises: Is there something about the life of an athlete that leads to such a premature end? Is there something about the strain of playing that

brought me neither championships nor glory, it never has been established that being a dilly is a safeguard against the dangers of athletics. So when the editor of POPULAR SCIENCE MONTHLY asked me to try to find the correct answer to the question "Do athletes die young?" I was vitally interested in the task—and a little afraid that the assignment would bring me a bundle of bad news.

STARTING with baseball, I at once discovered something that seems true in other sports—that the departed athlete here seems younger than he really was when death claimed him. The Christy Mathewson that we pictured when we heard of his death last fall was not the baseball club officer and war veteran who fought his losing fight against the disease that was a result of his service.

France, but the more youthful "Big Sam" of the New York Giants who won more than 40 games each season between 1915 and 1918. We remember our sport heroes as they were in the days of their

Considered from the standpoint of



His Heart Failed



A Hard Hitter at 54

After 35 years in the game "Iron Man" Joe McGinnity, old-time pitcher of the New York Giants, is still cracking the ball in a minor league. McGinnity earned his Big League spurs with the Giants more than 20 years ago.



Champions of 25 Years Ago Can Pull a Strong Oar Today

Veteran members of the eight-oared shell crew of the Vesper Boat Club of Philadelphia, Olympic rowing champions in 1900. At their twenty-fifth reunion last year, every man was in good enough

condition to pull an oar. They are Roscoe C. Lockwood, Ed Marsh, Edwin Hedley, William Carr, John F. Greig, James B. Juvenal, Harry L. DeBecker, J. O. Kelsey, and Lew Abell, coxswain.

longevity, baseball seems a highly desirable career. Frank Chance is dead, but the two other partners in the "Tinker to Evers to Chance" combination are alive and well. The famous "King" Kelly, most versatile of ball players, died under 50, but "Cap" Anson lived to be 70 years old. "Cy" Young, one of the greatest of pitchers, is operating a big farm at the age of 59. After playing baseball for 35 years, "Iron Man" Joe McGinnity at the age of 54, was pitching in a minor league last summer.

John Montgomery Ward, who broke into big-league baseball in 1877, and retired from the game in 1895 to devote himself to law and golf, died last year at the age of 65, of pneumonia contracted on a hunting trip. "Wild Bill" Donovan had left the 50-year mark behind him when he was killed in a railroad accident in 1923. Billy Sunday, the evangelist, who was a member of the champion Chicago White Sox in 1896, is active at the age of 62. Jake Daubert died in 1924 at the early age of 39 after an operation, but Wilbert Robinson, after a long career as a player, is president and manager of the Brooklyn National League club at the age of 62, and Hugh Jennings, 50 years old, is assistant manager of the Giants.



He Walks Far and Lives Long

Long walks and long life apparently go together. Edward Payson "Daddy" Weston, right, above, is 85 years old, but he still pulls up fresh after a hike of 100 up Lee or so.

Walter Johnson, Grover Cleveland Alexander, Ty Cobb, and Tris Speaker are among the many players who still are stars on the playing field although they are close to the 40-year mark. Baseball players, as a general thing, do not die young.

The death of Walter Camp came as a shock to the public, for he had come to be looked upon as the example and apostle of physical fitness. But it must be remembered that Mr. Camp, a man who

carried a heavy burden of business responsibilities, was 66 years old when he died, and as his football playing ended in 1881, it is scarcely just to charge that game with his death.

Football players also seem to belong to a long-lived tribe. It is true, there have been some tragic exceptions, such as Shevlin and Hogan of Yale, who died of pneumonia before they reached middle life, and Haughton of Harvard, who died of heart disease while coaching the Columbia team in 1924. But ten of the 22 players on the Princeton squad at the time of the first Yale-Princeton game were alive on the fiftieth anniversary of the

Olympic Winner

Martin Sheridan (below) New York police man and Olympic Games winner in 1904, 1906, 1908. Died at 37.



A Pair of Famous Baseball Veterans

John J. McGraw (left), manager of the New York Giants, and Wilbert Robinson, president and manager of the Brooklyn Robins. Their thirty-odd years experience left them smiling.



Keeps in Training After 71 Years

At 71 Jim Ten Eyck, famous sculler and rowing coach of Syracuse University, rows at least six miles a day just to keep in trim. This picture shows him, hale and hearty, out for a row on Onondaga Lake, New York.

game, and in 1924 six of the 13 players for Harvard who faced Yale in the first Harvard-Yale game in 1873 were alive. All but two of the players on the Princeton team of 1887 were alive 37 years later, and those two were victims of the war.

Turning to the loosely kept, and not too trustworthy records of pugilism, it is difficult to form any definite opinion about the effect of prizefighting on the length of life of its exponents.

Of the eight men who have held the world's heavyweight championship since 1890, six are alive. John L. Sullivan, the most famous prizefighter the world has seen, died in 1918 at the age of 60, after a career in which hard fighting and harder drinking played conspicuous parts. James J. Corbett, who won Sullivan's championship from him, is active on the stage and still frequents the gymnasium although he is nearing 60. But the conqueror of Corbett, Bob Fitzsimmons, pound for pound the greatest fighter of them all,

died at the age of 36. Jim Jeffries is alive at 50, and Tom Sharkey, the husky sailor who was close to the championship although he never won it, follows the races at the age of 51.

THE great fighters of the lighter classes have been less fortunate than the heavyweights, although Jack McAuliffe, the lightweight champion who retired undefeated, is alive and happy at the age of 60. The original Jack Dempsey, the Nonpareil, died at the age of 33. Joe Gans, the Baltimore negro who once held the lightweight title, died of tuberculosis at the age of 36. "Terrible Terry" McGovern did not live to see 40; George Dixon, a fine colored fighter who held the featherweight championship, died at the age of 30.

Many people think that running is bad for the heart, but available data on track and field sport do not bear out this contention. The wearers of the spiked shoe seem to live about as long as do other



The most recent night photograph along New York's Great White Way, where some 9,000 flashing electric signs turn night into day with the greatest concentration of artificial light to be found anywhere in the world. Today there are more than a million lamps in the signs on Broadway.

How a Million Lights Paint the Gay White Way

The Amazing Story of a \$20,000,000 Electrical Display

KEEP the lights alive—at any cost! That's the rule. If this big sparkler went dark for ten minutes, our company would lose \$1,000. But it's more than a matter of money. To keep New York's sky signs flashing through every second of their night life is a code of the game, with us.

"That's why trouble shooters like me are out on the roofs on a night like this."

With my informant, one of the guardians of the white lights of Broadway, I had fled from the storm into what he called the control shack. It crouched beneath the skeleton of a monster electric sign-board whose light would illuminate all the homes in a town of 10,000 population. That sign fetches a bigger rental than all the stores in the building above which it towers 50 feet into the night. It cost \$20,000 just to build; it contains two miles of electrical wiring, and its message is written in 3,000 ten-watt tungsten lamps.

From the theater streets below, more people could have seen that sign in the preceding 24 hours than live in the cities of Washington, D. C., and Portland, Ore., combined. It is one of 22 so-called "spectaculars" which if put together would make nearly two acres of dazzling brilliance. These tremendous flashing jewels shower Broadway with the greatest concentration of artificial light to be found anywhere on the earth's surface.

By MARSHALL D. BEUICK

Outside the operating hut where we shivered and talked, a biting gale swept down from the Hudson. Crowning the five-mile luminous chasm on the crest of which we were perched, the great signs that have made night on Broadway a spectacle unique in the world were flashing in kaleidoscopic restlessness. They seemed to be myriad in number, but an actual count shows that the great blaze over the 25 blocks of the theater district, including side streets, is made by barely a thousand major signs. In all Manhattan there are nearly 11,000 electric signs, of which 9,000 are to be seen along Broadway from its lower end at the Battery up to 135th street. About 2,000 of these are on restaurants, and 500 on theaters. There are more than a million lights in the signs on Broadway alone.

On the pavements 100 feet beneath us, there swarmed multitudes of black figures—part of a nightly audience of a million human beings for whose benefit my friend was tonight on guard to see that no single ray should fade amid this 25,000,000 candlepower of golden glamour.

The interior of the control shack echoed with the sputter and thud of automatic switches. The grinding mutter of revolving drums and the thumping of big magnets rose above the whistling

of the gale. I felt rather as though I had crawled into the steel entrails of some giant automaton, and were watching his mysterious life-processes at work. Rhythmically an uneasy blue glare flared up and died, revealing an apparent utter confusion of apparatus and switches and tangled wires.

"It makes a novice feel dizzy," I remarked.

"Well," admitted George, the trouble shooter, "it is a bit confusing. No use trying to explain exactly how it all works. To follow the miles of wiring and study the details of switches and circuits and fuses would drive you crazier than trying to solve an acre of cross-word puzzles."

THE current for one of these huge signs is directly controlled by contacts on that revolving drum, or a set of such drums. There may be ten or twenty of them in the big signs, all going at once. You can see that the drum is driven by a geared motor. The contacts are made of just the necessary length and placed in just the right spot to keep certain lamps on the sign lit for a set period of time. It works much like the old music boxes with cylinders and spikes that struck chords as they turned; only these cylinders play lights instead of musical notes. The rest is just a matter of wiring.

"These drums are all made-to-measure

in the electrical shops before the sign is erected. The electrical sharks in our laboratories can figure out on paper, with amazing accuracy, just how to arrange the drums and contacts so as to get the exact effect the sign designer pictured in his original sketch. In the spacing of those metal strips that you are looking at on the drum, these experts visualize the whole shifting picture that is operating above us. When you realize that the changing messages of the sign are made of thousands of lamps operating on dozens of circuits, you can see that some pretty clever electrical engineering was necessary to put this sign into operation.

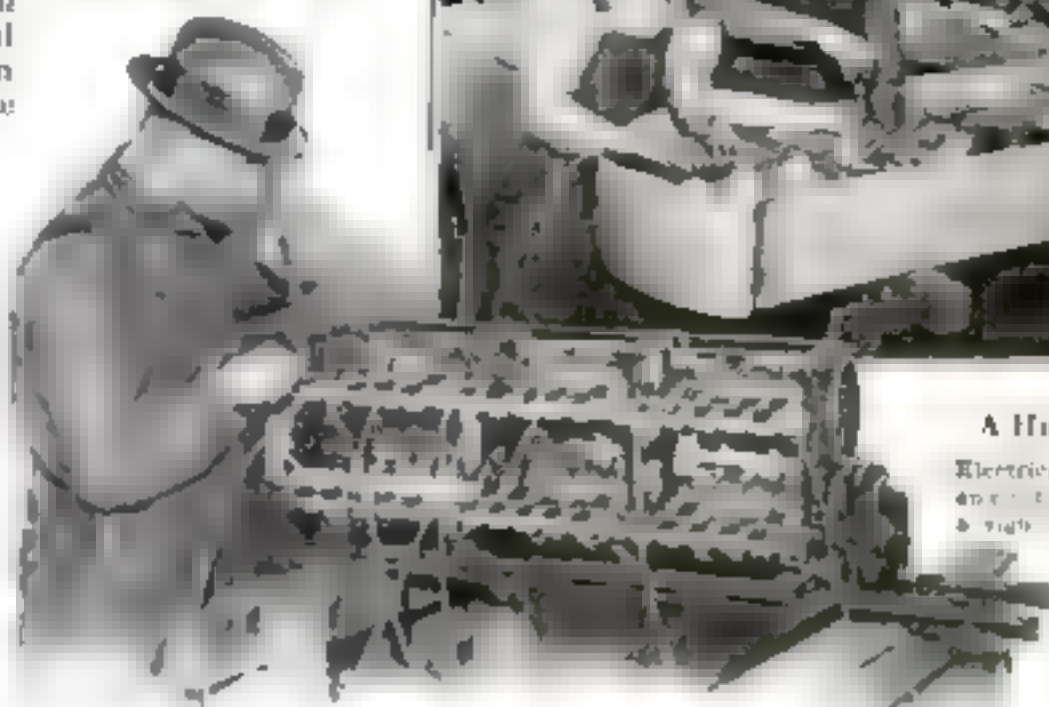
"YET the whole problem is all so completely worked out in advance that I've known the actual construction on one of these signs to start on a Monday morning, with crews working like mad, and a week from the next Tuesday evening I've seen the completed advertisement add its colors to the scenery out there."

In a lull of the storm George drew me outside, and we looked over the parapet of the roof.

"That whole spectacle may look to you like a haphazard jumble, but it isn't. Notice how each sign stands out from its neighbors in contrasting colors, as well as in shape and motion. Those signs

Flash Control

The revolving drum below controls the flashing of the lights, making electric contacts at exact intervals to give the desired effect in the sign.



A Huge Letter of Lights

Electricians wiring one letter of an eight-story sign above. Sometimes a sign has two stories of wiring.

to paint with light according to their own ingenious plans. Some of them are constantly walking the street

at night to study its possibilities and to make notes for possible improvements.

The expense of the big signs is so great that enormous pains are taken in designing them. Before actual construction begins, a preliminary drawing, worked up in color, is made. Then, a small, working model of the sign, accurate in every detail, is built of metal. Tiny lights flash the message exactly as the Broadway crowds will see it later, written 80 feet high in 2,000 tungsten lamps on 10,000 square feet of steel scaffolding.

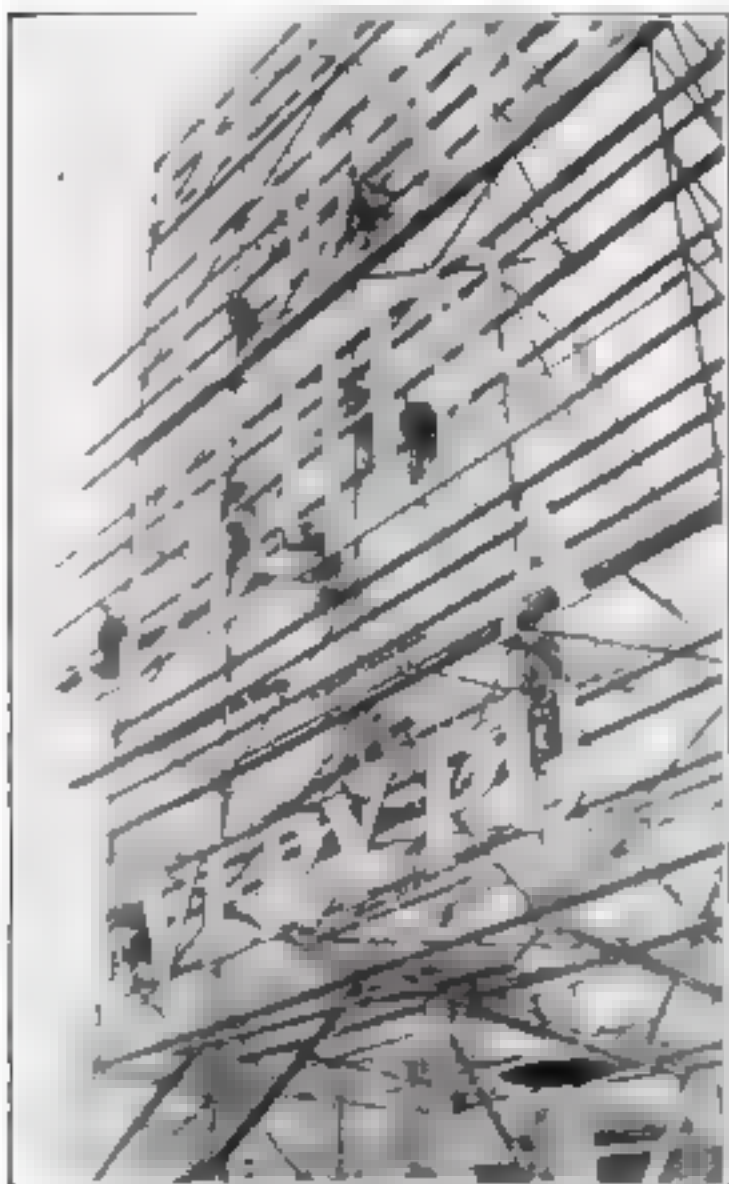
And then a motion picture of the model is made while it operates. This film of the miniature flashing sign is superimposed in the proper black and white on a night-time motion picture of the actual Broadway scene. When the manufacturer sits down in a projection room to be shown this film, he seems to be witnessing by magic the nightly display of his future "spectacular" over Times Square, weeks before a stroke of work has been done to erect it on its perch.

LARGE stocks of bulbs have to be kept on hand in the control shops, because the bigger signs like the famous chewing gum sign which had 17,000 lamps, eat up replacement bulbs by the hundred every week. Each night before the signs flash on, an inspector goes over them, testing connections with a voltmeter, replacing any lamps that a darkened glass indicates have only a few more hours to live. Other troubles may result from short circuits caused by weather-worn insulation or corrosion of old lamp sockets.

George told me that the job of the men who erect the signs is almost as simple as a boy's job of construction with a toy outfit. The iron workers put up the frame first with pieces of material that already have been cut in standard sizes in the shops. The pieces are marked in the shop, and drilled for bolts so that very little riveting needs to be done.

Sometimes the workmen get a thrill

(Continued on page 154)



A Printed Page of Steel

Structural iron workers fastening the great letters of a sign to the framework of steel. Construction of some of the largest signs costs from \$15,000 to \$200,000.

haven't sprung up aimlessly, anywhere and everywhere that some enterprising advertiser could get foothold for a steel skeleton. No, Broadway has been meticulously charted. There used to be a ceaseless battle to capture dominating positions, but now one company practically controls the whole show, at least as far as most of the best locations are concerned. Our firm holds many unused leases on every available building where a sign might conflict with one of the existing signs. It costs nearly as much to keep black boxes in the sky as to fill other spaces with light. We may pay \$2,000 for a single roof on which we never expect to erect a sign.

If this famous spectacle weren't planned as carefully as a huge stage setting, under muted control, then it would soon run all together in a meaningless jumble of lights.

Strict building and fire laws govern the erection of these signs. They have to stand high on stilts above the roof, so firemen can walk about underneath them in case of emergency. The steel supports are sunk in concrete and hooked up with the structural steel of the building. In one case they couldn't join the sign with the steel supports of the building, and they had to carry its legs all the way down through the walls to the ground.

"The roof signs have to be open skeletons. The force of a gale like this, hitting a solid sign, might rip the whole shebang loose and send it crashing down onto the crowd below."

From what George said, I learned for the first time that the famous Broadway kaleidoscope is the creation of highly paid engineers and artists, who consider Broadway their own stage and the night sky a backdrop for them.

New Links in the Ever-Growing



An Instrument for Taking a Census of the Blood

This ingenious new instrument, known as an "interference apparatus," was invented recently by C. G. Peters and B. L. Page of the U. S. Bureau of Standards. It is used to check the glass plates employed by physicians to count the number of corpuscles in a cubic centimeter of blood. The new apparatus, according to the inventor, will give accurate calculations that are infinitesimal—so little as two-tenths of a micron. A micron is one-millionth of a meter.

To help you keep pace with the march of science, *POPULAR SCIENCE MONTHLY* presents here, in concise form, a number of the outstanding discoveries and achievements of the month.

Has the Glass House Come?

SHALL we all live in glass houses some day? Mr. G. A. Shields, an Ohio inventor, claims to have found a way to make houses of glass, at a cost 20 per cent less than that of frame ones.

No paint, no plaster, no wallpaper. Soap and water would keep them clean and sanitary. For privacy's sake the glass is opaque and can be made in any color.

Mr. Shields' invention is a machine that makes glass slabs three-eighths of an inch thick, 30 inches wide and up to nine feet long. These are bolted to concrete foundations and screwed to a framework of wood.

Doctor Drinks Deadly Parasites

A HERO of science who came very near being a martyr is Dr. C. H. Barlow, a medical missionary in China. For the last 15 years he has been fighting a disease there, called "fasciolopsiasis," which has taken millions of victims. This disease, which distends the abdomen, is caused by a flat parasite that sometimes grows more than an inch long.

To find out effects of the parasite, about three years ago, Doctor Barlow swallowed 132 cysts containing undeveloped parasites. He was deathly ill for four months, but finally recovered.

Recently he decided that his own laboratory was too small for further research, and that he must take some live parasites to America for study. How to get them there was the problem. Then this brave scientist did a heroic thing. Taking 32 live flukes from the body of a patient, he put them in distilled water and drank them. Only when he reached the end of his long ocean journey did he tell any one what he had done.

Soap a Germ Killer

A CHEMIST, during the Great War, observed that large quantities of fat from the soldiers' dinner table found its way into the garbage and was disposed of accordingly. He decided that the fat was much too valuable to be thrown away and persuaded the authorities to establish a factory near Paris, where the waste fat was boiled with lye, which yielded soap and glycerine. The soap was sent to the trenches, and the glycerine was shipped to the nearest munitions factory, where it was converted into nitroglycerine, one of several powerful explosives.

Recently Dr. J. E. Walker, a New York physician, called attention to some new properties of soap. In removing dirt from the skin, soap also removes bacteria, which are apt to be found among the

Cheaper Houses Made of Glass—New Sources of Rubber—Some Other Useful Discoveries

"dirt" particles. Doctor Walker, as a result of his experiments, says that soap not only removes dirt and bacteria mechanically, but actually kills many of the latter, in much the same way that carbolic acid does, except that the soap is not so powerful in this respect as is the carbolic acid.

We are told that any ordinary soap is active enough to remove germs, so that in the process of a thorough washing of the hands with the formation of a good lather, a highly appreciable proportion of the bacteria that may be present are killed. Here is an additional reason for using plenty of soap.

Sugar from Artichokes

THE U. S. Bureau of Standards has found a way to get sugar from the Jerusalem artichoke and is now working to find how to produce it cheaply. The artichoke will grow anywhere in the United States, requires little care, and the tubers, from which the sugar is obtained, can be left in the ground over winter.

U. S. Death Rate Lower

THANKS largely to conquests made by medical science, the total death rate in the United States is decreasing, according to figures made public recently by the Department of Commerce. These placed the death rate for 1924 at 11.9 for

He Discovers How Egyptians Made Mummies

Doctor Francis Benard, of the Catholic University of America at Washington, D. C., is here seen holding a mummified fish. On the table in front of him are mummified fish. Doctor Benard recently won an exciting discovery in the long lost art of Egyptian mummification. With the use of a fluid that he has developed he says he can restore the original freshness of a mummy by immersing it in cold water. But the coveys are valuable additions to our knowledge.



Girdle of Science

1000 population, as compared with 12.5 in 1923. The number of deaths in 1924 among 90,030,494 people, or about 88 per cent of the population, was 1,173,900.

Automobiles are taking an increasingly heavy toll. Returns from 78 cities of more than 100,000 population each placed the daily average of automobile fatalities last year at 14.7, compared with 14.3 for the same period the year before.

The chief cause of death in 1924 was heart disease, which killed 170,671 persons, a slight increase over the preceding year. Deaths from cancer increased, the total being 61,941. Fatalities from tuberculosis decreased, the number being 89,724 in 1924, compared with 90,732 in 1923.

Synthetic Rubber in Sight

THERE is plenty of natural rubber still to be had, but we are using it up so fast that the end soon will be reached. In one year we require 350,000 tons of rubber for our automobiles alone.

Science sees another way out of this dilemma. There are ways of making rubber synthetically. Out of petroleum you can get a substance, butadiene, which is the starting point for the manufacture of rubber. The Germans did something along this line during the war when they were hard pressed and found it impossible to import rubber. Today not only are German chemists hard at work on the problem, but so are American chemists. Both these groups can make rubber of a kind, but the more pressing problem is to make it cheap, so that it may become a commercial success. It is fairly safe to make the prediction that the chemists will win in the end.

Monoxide Gas Detector

The U. S. Bureau of Mines has perfected a device to detect the slightest quantity of carbon monoxide in tunnels and mines. In the picture below Miss Agnes O'Laughlin is using the apparatus to prove that though cigarettes contain this poison, it is not enough to be really harmful.



Tear Gas Guns

The men in the above illustration are examining a tear gas gun. They are three members of a party of explorers who are about to invade Dutch New Guinea. They will use tear gas guns as weapons of defense instead of revolvers if attacked.

Another Chemical Victory

WHEN a couple of chemists some years ago showed the world how they could make indigo, their discovery ruined the natural indigo industry in India. Chemistry produces synthetic indigo more cheaply than the Indian can grow the indigo plant.

Some such change is going on in the hardwood industry today. If you take hard wood and distill it, you get such valuable industrial products as acetone, acetic acid, and wood alcohol, besides the wood charcoal that is left in the still.

Now we have recently learned how to make acetone and acetic acid by a fermentation process, and more recently a commercial method for making wood alcohol from its elements has been developed. Already the hardwood people are fighting for their lives, for the fermentation and synthetic processes are getting cheaper daily. Fortunately, many of the hardwood distillers are cooperating with the synthetic chemists. Eventually the hardwood industry like the natural indigo industry, must go to the wall, but there will arise a better and greater industry to take its place.

Aerial Night Photography

IN the dense blackness of night, a Martin bombing plane recently hovered over Rochester N. Y., 3000 feet in the air. Suddenly a flash appeared in the sky. There was a tremendous rumbling, and many windows broke from the vibration.

In the bomber the shutters of seven cameras clicked, and a motion-picture camera took advantage of the brief glare. When the pictures were developed it was found that this experiment in aerial photography at night was a complete success.

Army officials point out that taking pictures at night would be of invaluable help in time of warfare.

Through the Tail of a Comet

WHAT if some day the earth should bump into a comet's tail? What would happen? Well, you ought to know. For just the other day you whizzed through the tail of Biela's comet.

Compared with the earth, a comet is a porous thing, made of rocks and gases hanging loosely together. The only thing unusual as we shot through the tail was a shower of meteors that burned up like sparks from Roman candles far in our upper air.

Biela's comet was first observed in 1826. Whizzing through space, it was seized by the gravity of Jupiter. But this greedy planet, which has reached its tremendous size through just such stunts, didn't succeed in grabbing it for good. It did affect it, though, so that it had to start on a regular pathway around the sun. That is why we can see it at regular periods.

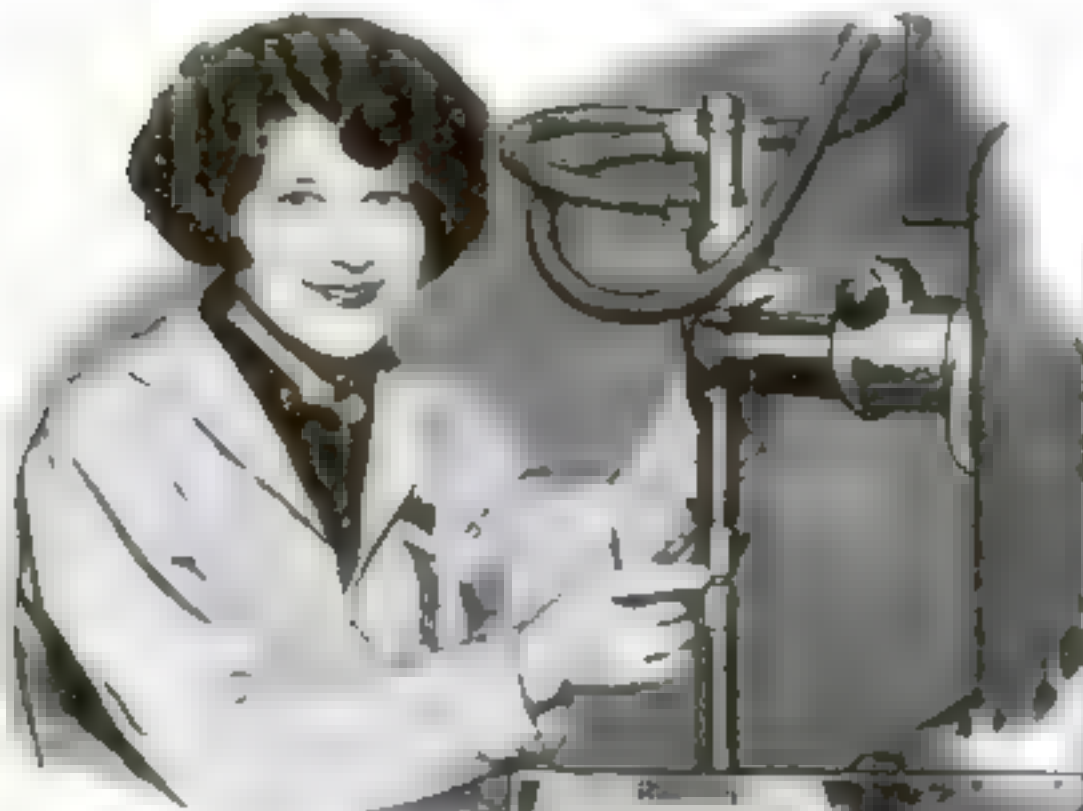
Every once in a while new comets are discovered. Two were found recently by American astronomers, Leslie C. Peltier of Delphos, Ohio, and Prof. George Van Biesbroeck of the Yerkes Observatory.



New Type of Muffler

Eugene Royer, of Paris, has invented a muffler for automobiles which, he claims, destroys, through a heating element, all smoke and the poisonous carbon monoxide gas that is a menace to city dwellers and to anyone working in a badly ventilated garage.

Women Who Hold Men's Jobs



Expert Woman Welder

Mrs. M. H. Jones, of the Connecticut Industrial Union, is a welder. She is one of the few women in the country who can weld. She is a member of the American Welding Society and has won many awards for her work.

She Follows Mining

Mrs. H. H. Jones, of the Connecticut Industrial Union, is a miner. She is one of the few women in the country who can mine. She is a member of the American Mining Society and has won many awards for her work.



With Synthetic Sunshine

Mrs. H. H. Jones, of the Connecticut Industrial Union, is a synthetic sunshine worker. She is one of the few women in the country who can work with synthetic sunshine. She is a member of the American Synthetic Sunshine Society and has won many awards for her work.



A Worker in Wood

Mrs. H. H. Jones, of the Connecticut Industrial Union, is a worker in wood. She is one of the few women in the country who can work in wood. She is a member of the American Woodworker Society and has won many awards for her work.



Mechanics for Children

Mrs. H. H. Jones, of the Connecticut Industrial Union, is a mechanic for children. She is one of the few women in the country who can work for children. She is a member of the American Mechanic Society and has won many awards for her work.

Behold "Mrs. Hercules"

That is Mrs. Angelina F. Jones, of the Connecticut Industrial Union. She is a Hercules. She is one of the few women in the country who can be a Hercules. She is a member of the American Hercules Society and has won many awards for her work.



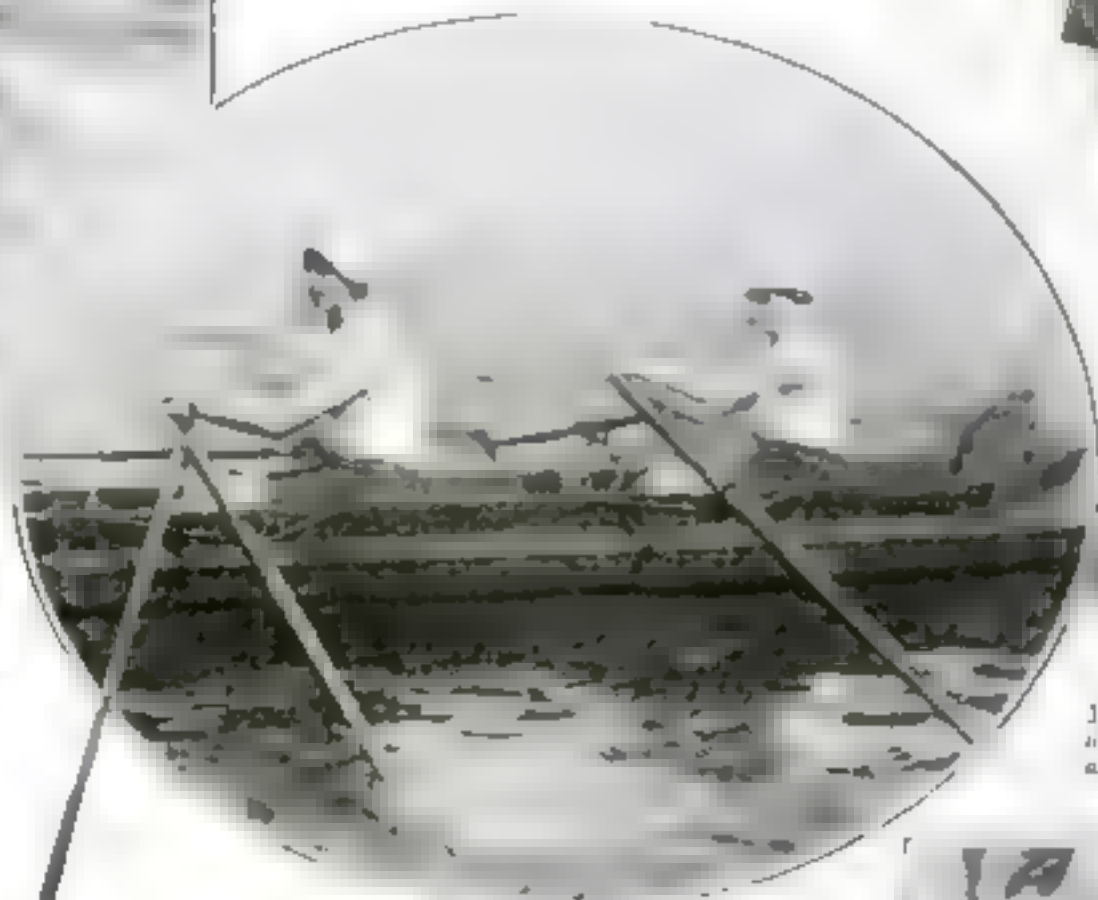
Seven Ways in Which Seven Men Defy Age

THE veteran sport shot on this page has not only a record of 100 years but also a record of 100 years of work in the same field. The record book shows that he has worked two hundred and thirty years.



His Daily Dip

The Minneapolis talk of the day is that of the man who has been in the water every day for 100 years. He is now 100 years old and has been in the water every day for 100 years.



A Round a Day

The man who has been in the water every day for 100 years is now 100 years old. He has been in the water every day for 100 years.

Two Ancient Mariners

The man who has been in the water every day for 100 years is now 100 years old. He has been in the water every day for 100 years.



Golf Does It

The New York banker and retired man who has been in the water every day for 100 years is now 100 years old. He has been in the water every day for 100 years.



Hunter at 90

The man who has been in the water every day for 100 years is now 100 years old. He has been in the water every day for 100 years.

Age No Drawback

The man who has been in the water every day for 100 years is now 100 years old. He has been in the water every day for 100 years.

Famous Train Installs an Electrical Kitchen



THE famous train between London and London has a complete electrical kitchen in its dining car. The electricity is supplied by the motor of the train.

Cooking by electricity in the kitchen to occupy the minimum of space, which obviously is of great importance in diner construction. All temperatures can be regulated exactly and the kitchen kept spotlessly clean. Like many a house-

A Lamp that Casts No Shadow Has Many Uses



HERE is something that would fit right in a huge raising, nerve thrilling mystery story—a light that casts no shadow. In the photograph you see that though the woman's hands are clearly between the light and the table, there is no trace of a shadow.

Getting rid of shadow is of immense value for surgical operations, laboratory work, engraving, and other work where close application is necessary. A high power lamp is fitted in the center of an inverted flat bowl of sheet metal lined with silvered reflectors. Around the

Compact and Clear

A	10	10	10
B	10	10	10
C	10	10	10
D	10	10	10
E	10	10	10
F	10	10	10
G	10	10	10
H	10	10	10
I	10	10	10
J	10	10	10
K	10	10	10
L	10	10	10
M	10	10	10
N	10	10	10
O	10	10	10
P	10	10	10
Q	10	10	10
R	10	10	10
S	10	10	10
T	10	10	10
U	10	10	10
V	10	10	10
W	10	10	10
X	10	10	10
Y	10	10	10
Z	10	10	10



The train's motor runs it

wife, the chef on this famous train is now a firm believer in the merits of cooking by wire.

lamp is a cylindrical prismatic lens that deflects rays of light onto the reflectors on the edge of the shade, where they are thrown down in a circle of highly concentrated light. The diameter of this circle can be varied. A special glass cover on the lamp keeps heat from striking the operator.

Wooden houses, once looked down upon because of the unpleasant reputation they give unwelcome intruders, are now being regarded more highly. Next to muskrats, skunks are the most important fur-bearing animals in the United States. Thirty-four states protect them by law.

Runs Motor Bus on Rails for Greater Speed

ECONOMY for the railway company and comfort for the passengers are assured in this motor bus and trailer operated on a railway track in England. The only way in which the vehicle differs from a bus traveling on the highway is that its inflated tires have been replaced with flanged wheels.

Greater speed and also less consumption of fuel are two big advantages claimed for it.



Motor bus and trailer operated on railway track



Novel Type of Key Holder Is Handy in Use

IF YOU ever have stood in a dark hall, trying to disengage your key from its entanglement with the other keys in your ring, you know how trying is the habit of keys with the ordinary ring. Here is a new type of key holder in which the key swings out like the blade of a knife. This new device, it is claimed, makes each key quickly available and eliminates the necessity of handling the whole bunch of keys in order to find the one you want. This new holder carries the keys flat and it is provided with a leather case to protect your pocket or the lining of your bag.

The Human Voice to Control Electrical Current?

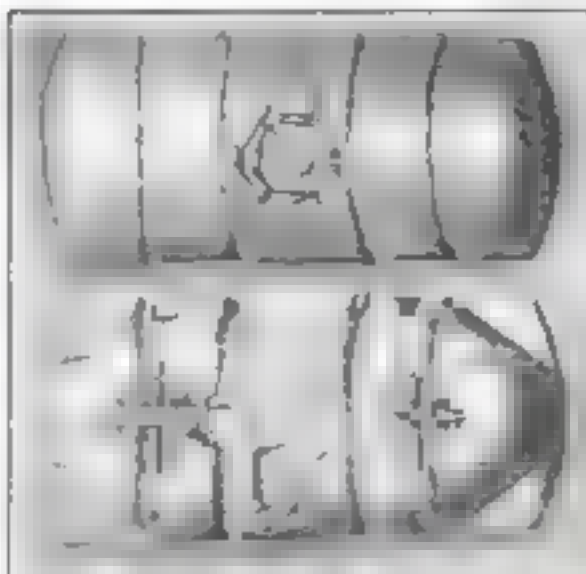
AN ENGINEER of Nottingham, England, claims to have discovered an invention that controls electric current by speech. It is possible by this invention, it is said, to stop and release current. The sound waves of the voice are transformed in such a way that they will control any electrical circuit.

Through a mechanical error which resulted in the omission of several words, an item published in our January issue stated that Charles Hoff, world's record holder in the pole vault, is a native of Denmark. As a matter of fact, Hoff is a Norwegian. His record vault, however, was made in Denmark, and this is the information which the article was intended to have conveyed.

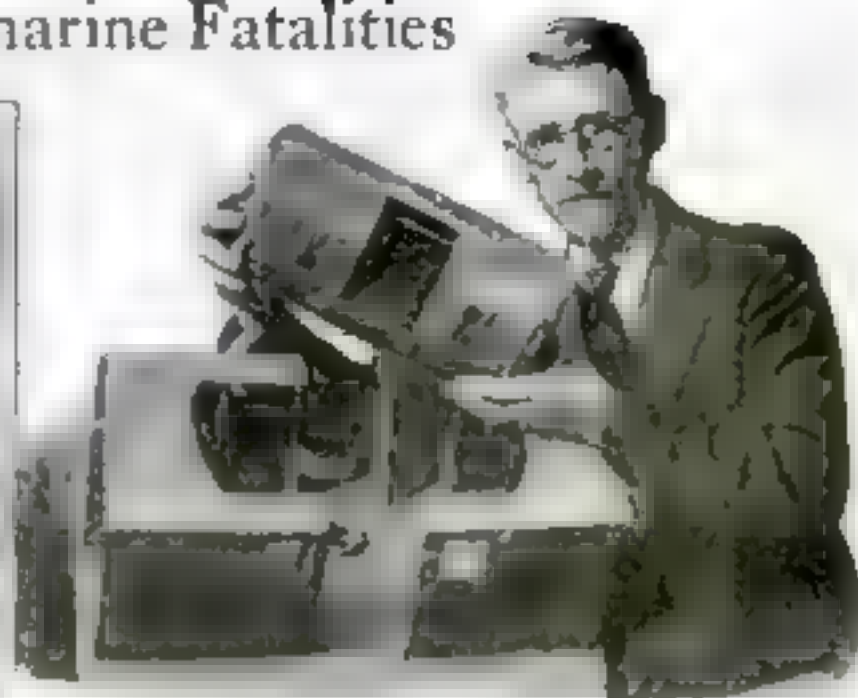
He Says His Lifeboat Prevents Submarine Fatalities

A RESIDENT of San Francisco, Daniel J. Carr, has invented a lifeboat to be carried in submarines. It is a cylindrical steel compartment that would be accommodated in the superstructure of the sub's walking deck. The floor door is fastened in such a manner that in an emergency it could be released readily, when the boat would float to the top of the sea by reason of its own buoyancy.

Once the boat reached the surface, it could be fully opened and an SOS sent out by a small wireless set.



The inventor, Daniel J. Carr, is shown here holding a model of his lifeboat.



Mechanical Rack Raises Car Easily to Working Height



IF YOU ever have had occasion to get under your car, without the assistance of a mechanical device to raise or tip it, you will appreciate a recently invented rack mechanically operated, which is at once a tipping, conveying, and service device. The rack will accommodate itself to any make of car.

The rack, which requires no installation work or pits, is placed on the level, and the car is driven on it. The rear wheels of the car are held in position by steel blocks, and the car is tilted and held at an angle of 40 degrees by a one-horse-power motor. Now you can get at all comfortably, for the car is held at a convenient working height.

New Plane Designed to Climb Nine Miles

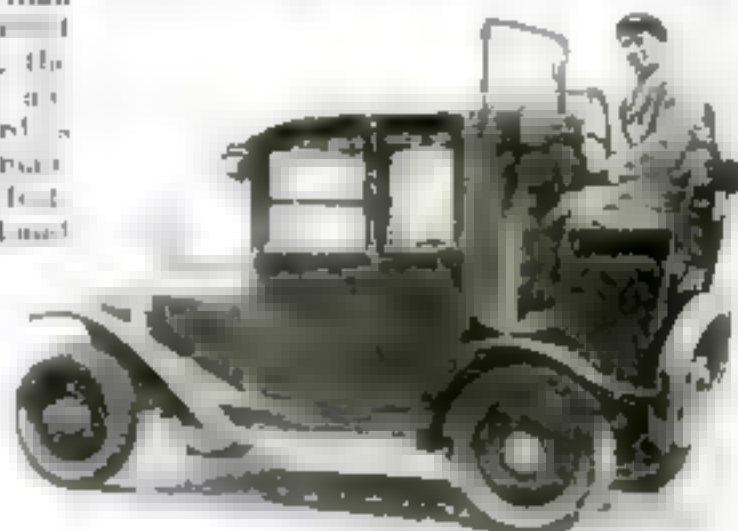
TO RAISE still further what aviators call "the ceiling" of the sky, a remarkable new type of airplane designed to climb an altitude of 50,000 feet or more than nine miles, is being constructed at McCook Field, Dayton, O. The War Department recently announced. The present record is held by M. C. Galt, a Frenchman, reaching a height of 30,500 feet. Wings of extraordinary lift and

a propeller of unusual diameter are being installed in the new plane to provide increased lifting power in the rarified upper atmosphere. The wings, of wood and fabric, will have an area of 600 square feet. A 400-horse-power engine drives the machine.

Motorized Hansom Cab Is Now Popular in Paris

ANY elegant old gentleman about town, in London or New York, will tell you of the comfort of the hansom cab, and the delight of driving in one, with doors wide open, down Pall Mall or Fifth Avenue, on a sunny day in spring. Perhaps we soon shall have an opportunity to test the truth of his tale. There recently appeared on the streets of Paris a new type of taxicab that caused a sensation but at once became popular—the "motorized hansom cab."

The new taxicab borrowed the idea for the driver's seat from the hansom cab and placed it high at the rear of the vehicle.



New Kite Inspired by Flettner's Rotor Ship



The rotor kite, recently flown in Germany.

SINCE the time Flettner's first ship skimmed over the water propelled by a huge rotating cylinder, last year, inventors have been working on adaptations of this new way of propelling craft. In the photograph is seen a rotor kite flown at a recent aerial jubilee at Landsberg, Germany.

The kite is sailed on exactly the same principle as the ship, wind striking a rotating cylinder, creating force and suction.

The occupants of the cab thus are afforded a clear view of the road in front of them and business men need not fear that the grave trade secrets will be overheard by the driver. The drivers also can better survey the street ahead.

Devices Invented for Raising Sunken Submarines

RECENTLY news came from Tokio that a Japanese had invented an entirely new device for raising sunken submarines. Almost simultaneously with that news comes word that Dr. J. Townsend Parr, of Oakland, Calif., had perfected an invention to bring sunken ships to the surface without the aid of divers. Patents have already been taken out and on advice of the naval authorities the plans have been sent to Washington for the perusal of submarine experts and naval heads.

The Most Thrilling



He Built His Own

Not satisfied with the big airplane of today, the young man, William A. W. built his own. It is a big, multi-engine plane, and it is the most powerful airplane yet built. It is a big, multi-engine plane, and it is the most powerful airplane yet built.

A Lucky 13

Nature's power is the most powerful of all. It is the power of the wind, the power of the sun, the power of the water. It is the power of the wind, the power of the sun, the power of the water. It is the power of the wind, the power of the sun, the power of the water.



Charleston in the Air

Above "Spider" Mott, Al Johnson and "Spider" Mott. Above "Spider" Mott, Al Johnson and "Spider" Mott. Above "Spider" Mott, Al Johnson and "Spider" Mott. Above "Spider" Mott, Al Johnson and "Spider" Mott. Above "Spider" Mott, Al Johnson and "Spider" Mott.



Speedy Planes to Fly from Boston to New York in 58 Minutes



Paris to New York

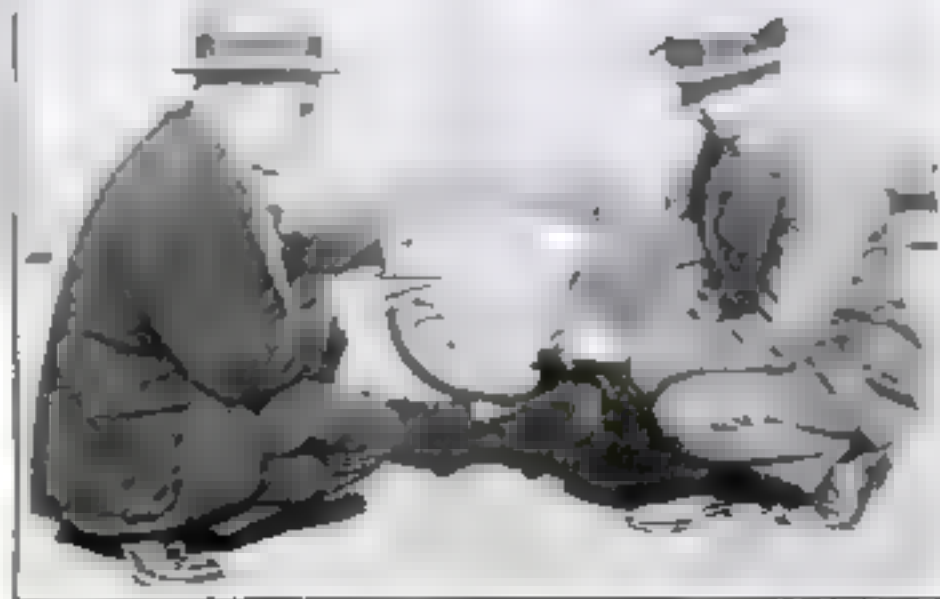
Above is the Paris to New York. Above is the Paris to New York. Above is the Paris to New York. Above is the Paris to New York. Above is the Paris to New York. Above is the Paris to New York.

New Type Airship

For five years Thomas H. State of Connecticut. Carl has been working on an idea for a new type of airship. For five years Thomas H. State of Connecticut. Carl has been working on an idea for a new type of airship.



Above is F. T. K. of the American Engineering Society of Boston. Above is F. T. K. of the American Engineering Society of Boston. Above is F. T. K. of the American Engineering Society of Boston. Above is F. T. K. of the American Engineering Society of Boston. Above is F. T. K. of the American Engineering Society of Boston.



This Phone Meter Registers Length of Calls



IF YOU use your telephone very little, and Mrs. Jones down the line uses hers for 30-minute visits, then she ought to pay more for her service. So believes a California man who has devised a way to make her pay.

Frank N. Rich, of Los Angeles, invented this new meter device that registers calls by their length. It is worked by a mercury switch operating on the principle of an hourglass.

The usual method of paying for the telephone by the number of calls, Mr. Rich protests, is like paying for water according to the number of faucets used. One faucet may run 10 times as much water as another. One telephone call may consume 30 minutes, another only 30 seconds. The picture to the left shows Mr. Rich and his invention.



Wire Clamp that Replaces 42 Other Devices

IF ALL that is claimed for it is true, this sturdy turnbuckle clamp must be worth its weight in gold. The maker declares that for fastening wire, whether to stretch it or for other purposes, the clamp does all that 42 other articles can do and he lists the 42 items which he thinks his clamp may replace.

It is useful as a ground-wire clamp also, giving a better electrical connection, as it brings the wire in direct contact with the pipe. The same is said to be true of the clamp if it is used in place of a standard feed cable tap.

First Electrically Driven Passenger Ship

WHEN the *Gripsholm* sailed up the Hudson River in New York recently, the huge motor-driven liner was the first of its kind seen in America. No smoke, no soot, for not a particle of steam is used on this Swedish ship, not even for heating or cooking.

Although it has no need for funnels, the *Gripsholm* carries two, just because we are used to seeing them on ships. One of the funnels is used for an elevator shaft and the other for ventilation and to carry off the motor exhaust.

The ship has six decks and accommodations for more than 1400 passengers. Two Diesel engines propel the liner. Compressed air pumps the crude oil used for fuel into the cylinders, where it explodes somewhat like gasoline does in an automobile engine.

Lighting, cooking, and heating all are done with electricity. Even the hoisting apparatus for baggage and freight is operated electrically.



In the above illustration a workman is shown using this convenient drill to bore out a lead terminal in a storage battery.

New One-Hand Drill

HERE is a light electric drill, weighing but 3¼ pounds, that may be operated with only one hand, may be carried about easily and can be handled for a long time without fatigue to the operator. The grip of the drill being on a direct line with the chuck gives a straight-line pressure on the drill bit, thus eliminating side strain.

The motor of the drill is ventilated thoroughly and cooled by air drawn through the handle and exhausting through portholes in front of the motor.

At THE HAGUE, in Holland, a telephone subscriber can have radio also, for a unique installation has been made that enables telephone subscribers to get broadcast music over the wire by calling up a special radio number. The radio connection is broken off automatically if the subscriber's telephone number should happen to be called.

An Instrument to Test Solid Concrete

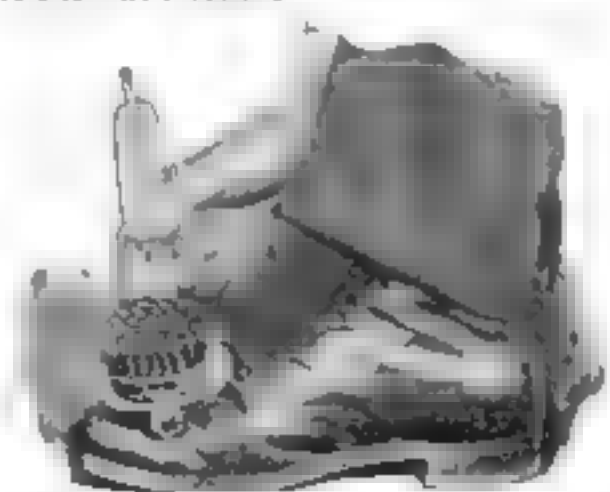
THE U. S. Bureau of Standards has developed an electrical device, called a "telemeter," to measure accurately the stresses and changes of pressure in a solid concrete structure. The telemeter consists of a stack of carbon disks, both ends of which are connected by electric wires with recording instruments. The electrical resistance of the carbon disks varies with the pressure put upon them.

A concrete dam, in course of construction in California, will be tested to the breaking point by the new device. While the liquid concrete is being poured, the carbon disks, placed in cartridges, will be inserted into it, and the necessary connecting wires will furnish a complete record of the increasing pressure and the resulting stresses.

Shoe-Polishing Outfit at the End of a Handle

DAIBER, brush, and polisher all at the end of one handle—that's compactness. Stephen Murphy, of San Francisco, never could keep together all the things needed for polishing his shoes, so he used his inventiveness to figure out the handy combination illustrated.

The dauber for the shoe polish fits in between the brush and wool polisher. A push on a lever on the brush handle brings it out when needed.



The above device contains three articles in one—a shoe brush, a polisher, and a dauber.

A Lock Washer that Will Really Lock

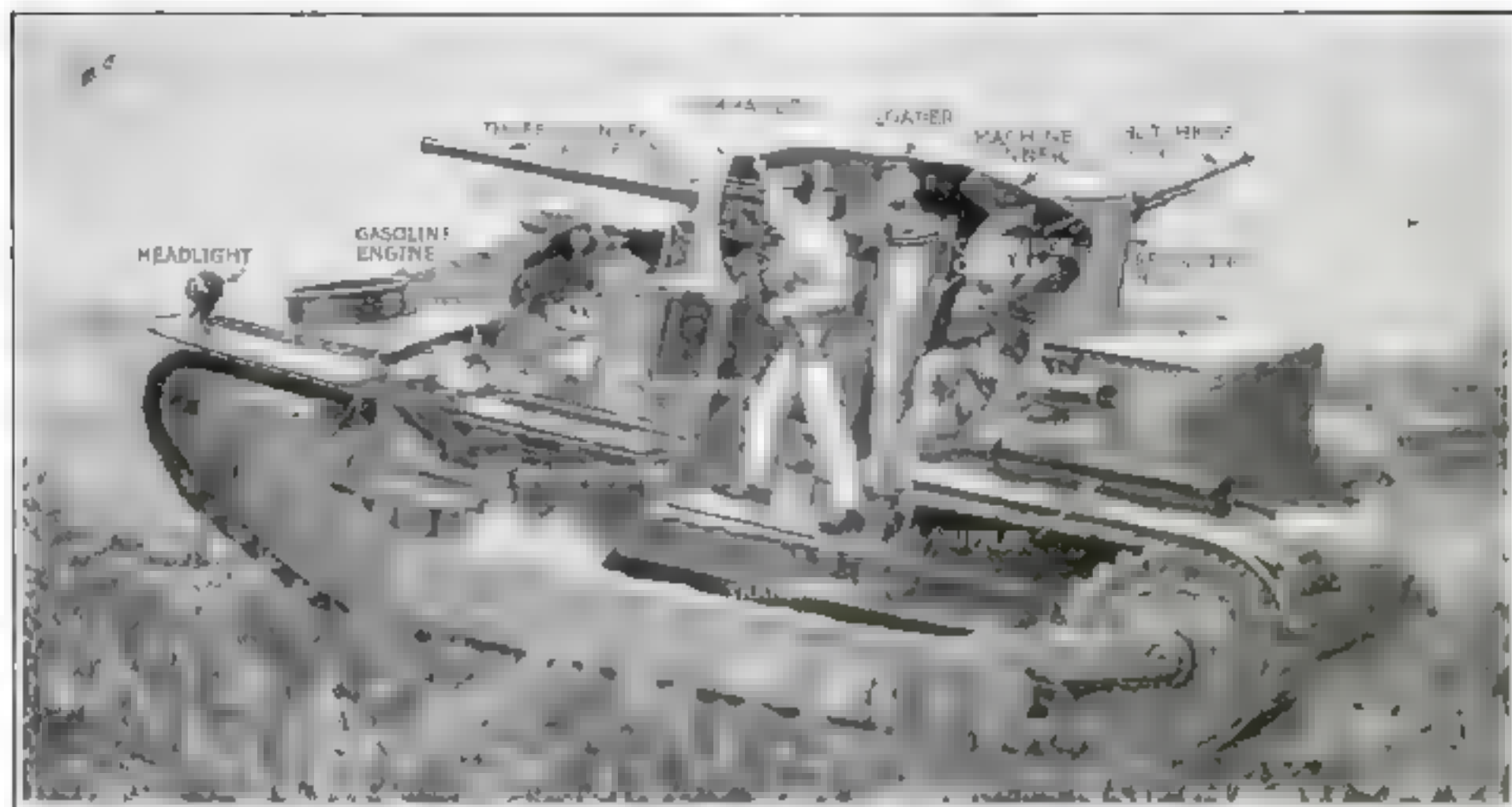


A LOCK washer that really locks in the clamp for this thin ring of highly hardened steel cut in the shape of a miniature gear. The teeth are set at a slight angle so that when pressed be-

tween a nut and a metal surface they dig into the softer metal. This is said to prevent vibration and keep the nut from working loose.

The new washers are made in all sizes and are suitable for all classes of machinery in the automotive industry, in railroad track work, and structural work. A close-up picture of the new lock washer is seen above.

New Type of Armored War Tank Appears in England



THE light tank illustrated above is Britain's latest achievement in this type of war machine. It is 17 feet long and 8 feet 6 inches broad. A three-pounder quick-firing gun is the main

armament with Hotchkiss and Vickers machine guns to back it.

Five men make up the crew—a driver, a loader, two men for the machine guns, one a reserve driver, and a gun layer for

the three-pounder, who is usually the commander. This tank can travel over plowed fields at a rate of 30 miles an hour—four times as fast as the old tanks first used during the war were able to go.

Carry Your Chair with You in a Cane

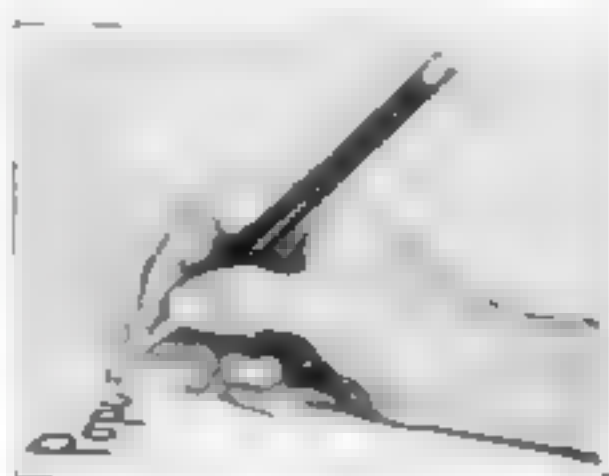


A CANE that also serves as a seat is a familiar sight in England, where spectators use them at polo meets, races, and on the moors in the shooting season, also on the seasonally outdoor sports, and between events. Now that it has reached the United States we may find other uses for it.

Usually made of a light but sturdy wood, the crooked head of the walking stick opens in two parts that bend down in opposite directions to form a seat. Closed, it looks like an ordinary walking stick. A metal disk that usually is fastened near the stick's handle,

slides over the point at the bottom, holds fast, and keeps the stick from sinking too far in the ground.

Though angleworms cannot distinguish objects, they are not blind. They have light-sensitive organs distributed along the whole length of their bodies that perform the function of the normal eye.



Fountain Pen Is Designed for Lettering

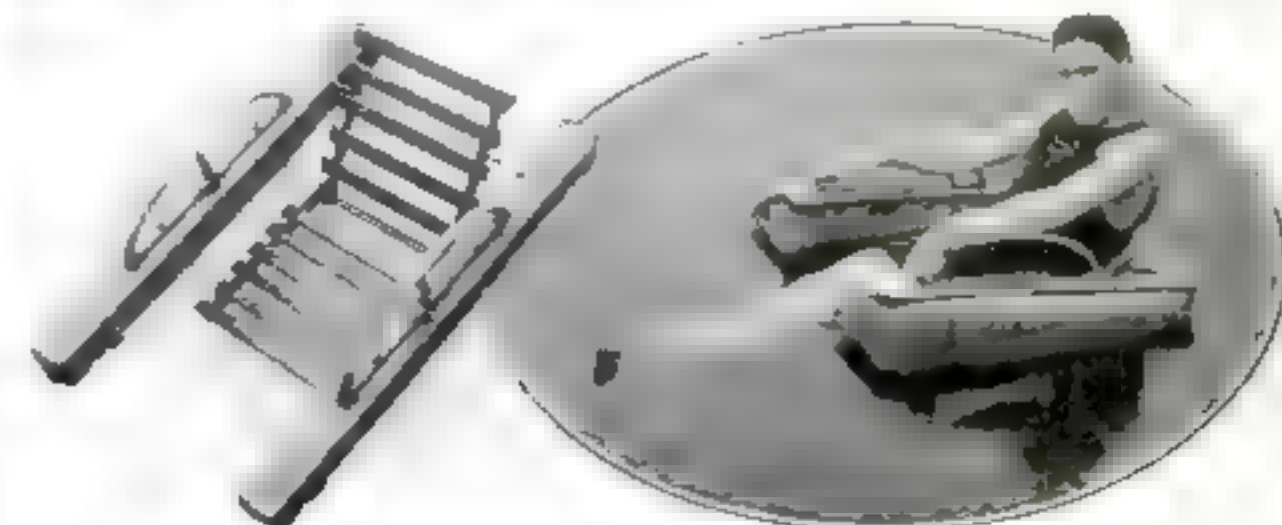
LETTERING can be done with the ease of writing, it is claimed, with a new fountain pen made specially for this work. There is a constant flow of ink automatically controlled by the pressure used in writing, and by it letters can be formed continuously, without having to patch them up later. The lettering is done with a rigid marking disk. An illustration of the new pen is seen at the left. The ink reservoir is toward the top.

A Collapsible Floating Chair for Bathers

THE inventor of this collapsible floating chair for bathers is Thomas La Farga. The bottom and back of the chair are made of slats. A piece of U-shaped rubber tubing is fitted between

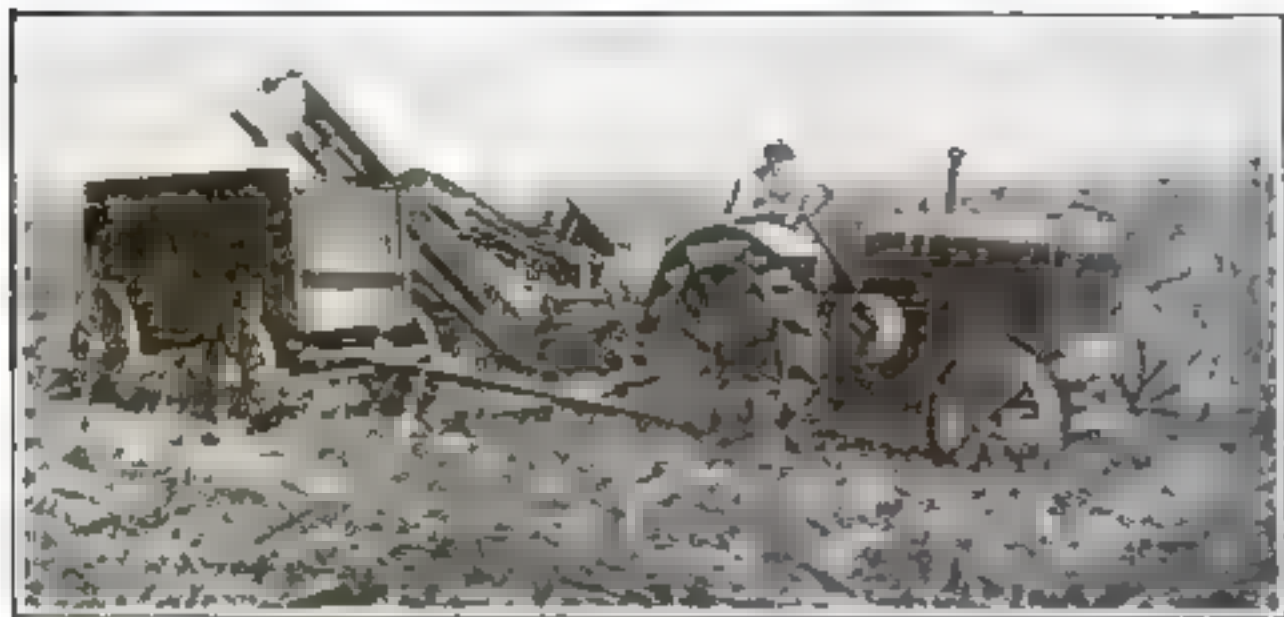
two boards at each side. Curved pieces on top of the boards serve as handles.

When deflated, the tube can be rolled up, and the collapsible wooden parts can be carried in a small, compact package.



Above, at the left, is a plan view of the improved floating chair. At the right, the inventor is seen seated comfortably in his new creation, which is designed to bring joy to the sea bather.

Ingenious Machine for Picking and Husking Corn Rapidly



This machine picks and husks seven acres of corn a day

Tree Seeds Threshed by Machinery

ON LANDS bared by forest fires, nature can't be depended upon to repopulate forests quickly enough. United States foresters must help by sowing tree seeds. But it takes 200,000 seeds of Western yellow pine to plant a single acre. Collecting all these and getting them ready for sowing is a real job.

In the photograph to the right is a threshing machine used to remove the wings from Western yellow pine seeds in order to reduce their bulk and make them easier to plant.

Out of 200,000 seeds, half may germinate, but only about a thousand seedlings reach a height of one foot, and of these probably only 30 will reach maturity.



Men in the photo above are threshing Western yellow pine seeds for forest planting

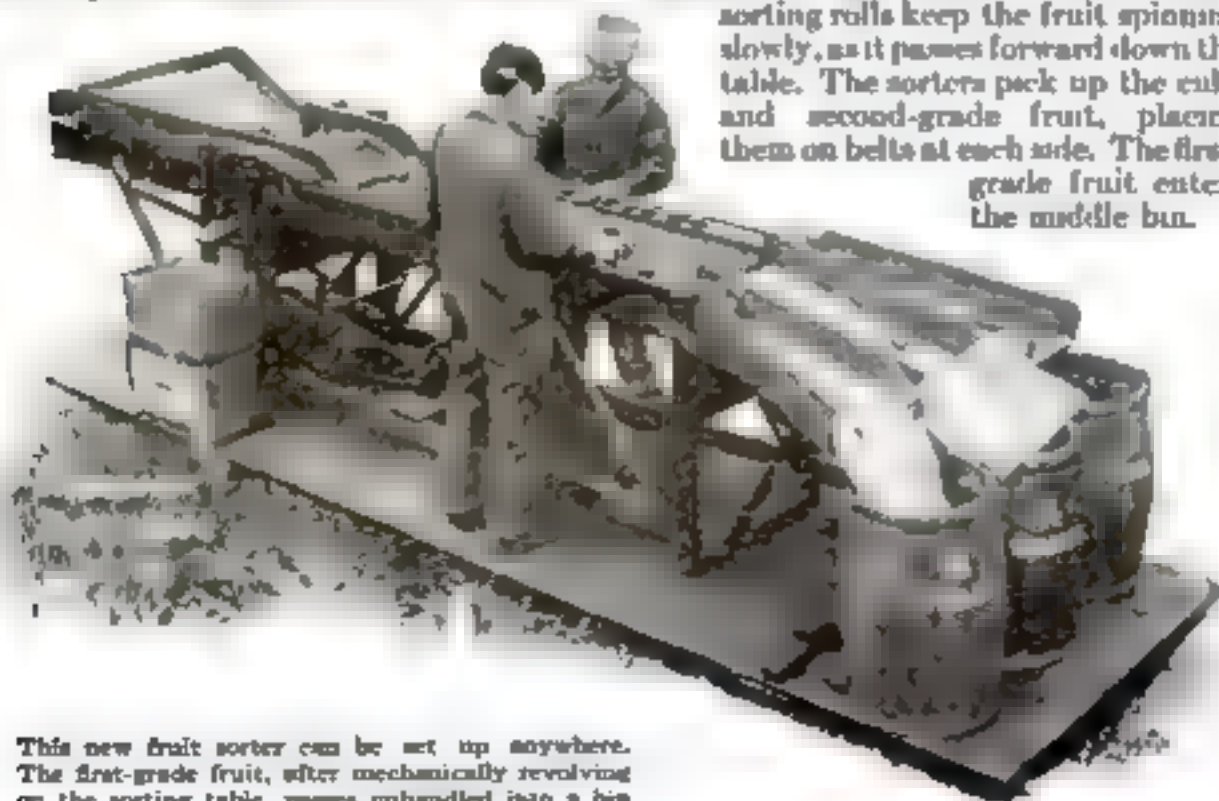
A NEW yarn, with the warm, soft feel of lamb's wool, now is being made from the waste product of the artificial silk industry. United States Department of Commerce officials hold out a great future for the new fabric, which already is being

manufactured in the United States as well as being imported from Italy, where it started. The new 'wool' is shimmery and dyes in beautiful colors. Combined with real wool in making serge and other goods, it improves its appearance, as silk does.

An Orchard Device to Sort Fruit Mechanically

ANOTHER machine to save cost of labor. This mechanical fruit sorter which can be carried out into the orchard and set up anywhere, is said to be much more rapid and efficient than the usual

hand methods. Oranges, apples, or other fruit are fed from a hopper to a wide perforated rubber belt. The underripe fruit falls through the perforations and is delivered to the side, while six spiral sorting rolls keep the fruit spinning slowly, as it passes forward down the table. The sorters pick up the culls and second-grade fruit, placing them on belts at each side. The first-grade fruit enters the middle bin.



This new fruit sorter can be set up anywhere. The first-grade fruit, after mechanically revolving on the sorting table, passes unhindered into a bin

OPERATING at three times the speed of a hand picker, a machine for picking and husking corn in the fields has been added to equipment designed to make farm work easier. It is hitched to a tractor and is run by power obtained from the tractor by means of a special power take-off attachment that works in soft ground where traction is poor.

Delmar Van Horn of Rippey, Ia., is shown in his machine, which is said to pick from five to seven acres of corn in a 10-hour day, thus saving time and labor.

High Altitudes Destroy Plane Power

TESTS made by the U. S. Bureau of Standards show that the engine power of a plane is reduced one-third when it rises to an altitude of 40,000 feet above sea level. Many experiments were made and they all demonstrate that the loss of power is caused by the steady drop of air pressure, as the machine ascends. An airplane motor in high flight may be compared to a mountain climber who invariably weakens at high levels.

Most people know that the flavor of apples improves with keeping. Recent research shows that this is due to the gradual reduction in the apple's acidity. This decreases at first rapidly, then more slowly. In apples kept in cold storage the loss of acidity is a much slower process. If an apple has too much acid when it is first put into cold storage, it is likely to decay.

A New Fuel from Bark



PRESSED bark, mixed with wood waste, is a new fuel that can be used to replace some of the coal required by mill boilers. When 50 per cent of the moisture which the bark contains is removed, the bark is changed from an unburnable waste, which will not burn alone, into a low grade fuel.

The bark is put into a special press. In this machine chunks of wood and the smaller splinters, such as are usually lost in the water in a paper mill, are hauled along with the bark and used also. In the upper right corner, is shown a handful of the new fuel. In the left lower corner, a sample chunk of the unpressed bark.



A Convenient New Frame for Hacksaw Blades

THE above photo shows a convenient holder for hacksaw blades used in cutting corrugated iron and other sheet metals, asbestos sheets, etc., and various compositions, if set in this new saw frame, an English invention. The blade is set at an angle so that it will cut through any length or width of material.

It is used like a carpenter's hand saw, and will take care of jobs that ordinarily require a hammer and cold chisel, or a large pair of shears, and that frequently ruin the teeth of the usual hand or panel saw.

She Keeps Her Golf Score on Her Bracelet

CARRYING your golf score on a wrist-band is the latest innovation for the golf links that recently arrived here from England. The score for two players fits in a leather case strapped around the wrist.

The whole thing, including pencil, is little larger than a wrist watch and provides a convenient way to keep track of



Keeping score on bracelet card

the score. Mrs. Henry Graves of Chicago and Miss Edith Renard of Boston are shown above making use of the score card wristlets for the first time.

Pianos for the Tropics Must Fight Moisture

WHEN you think of what happens to your piano during damp weather, you can imagine what would happen to pianos in the tropics, with the long rainy seasons.

Pianos for the tropics are built especially to withstand moisture. No veneer can be used, only solid wood; all joints must be dovetailed together instead of using glue. The wood must be insect-proof, such as cedar, and the felt inside must be soaked in insect poison. All iron parts are varnished and steel strings gilded to prevent rust. And the key-covering must be moulded of celluloid in one piece.

A Fire Truck with Self Supporting Ladder

In the illustration below is shown a new type of fire truck with ladder folded in quarter for use.



LOUISVILLE, Ky., recently acquired a new type of fire truck with ladder which is not supported against a burning building, but stands on its own base.

When extended to its full length the ladder is 85 feet high and can hold eight men with safety, it is claimed. When not

in use it is lowered to 14-foot sections that rest over the driver's seat. This unusual truck, which was designed in Germany, recently toured New England and was used in other localities during the National Fire Prevention Week ceremonies.

A member of the research staff of a large chemical laboratory in Long Island City, N. Y., Dr. G. O. Curme, Jr., claims he has discovered an anti-freeze compound for motor cars that meets the requirements of the U. S. Bureau of Standards. The new compound is ethylene glycol, which combines the valuable properties of alcohol and glycerine.

For every two persons in the United States there is one cow. We have the second largest herd in the world. India has 140,000,000. We have 60,000,000 swine, four times as many as in any other country. Corned beef and cabbage may be cited as our favorite dish, but statistics show that we eat more pork in the United States than any other meat.

How Quickly Can a Trolley Car Stop?

AT A recent trial in a California city a young woman was suing for injuries suffered in a streetcar accident. An ex-motorman testified that a car traveling 20 miles an hour could be stopped in a space of 30 feet. The young woman's counsel denied vehemently the ex-motorman's statement. They agreed to a test, and jury went to the scene of the accident and saw the test.

A special speedometer was used in the test—a wheel attached to the side of the car.



Above, on the left: A judge and jury watching to see how fast a trolley can stop. Observe (on the right) the special speedometer used in the test—a wheel attached to the side of the car

Masters of Curious Jobs



Maine's Champion Fiddler

The world-famous Maine fiddler, who has won many prizes at fiddle contests, is shown here in his workshop. He is a native of Maine and has been playing the fiddle since he was a boy.

A Dealer in Antiques

The dealer in antiques is shown here in his shop. He is a native of Maine and has been dealing in antiques since he was a boy. He is a native of Maine and has been dealing in antiques since he was a boy.



The Soups in Sogut



Unique Bow and Arrow Maker

In a little shop in Jersey City, N. J., James Duff, who was born in Scotland, makes expert archery equipment for the leading archers of the world. The bows are made of lemon wood, tipped with South American horn, and the arrows are fashioned from straight and light Norway pine.



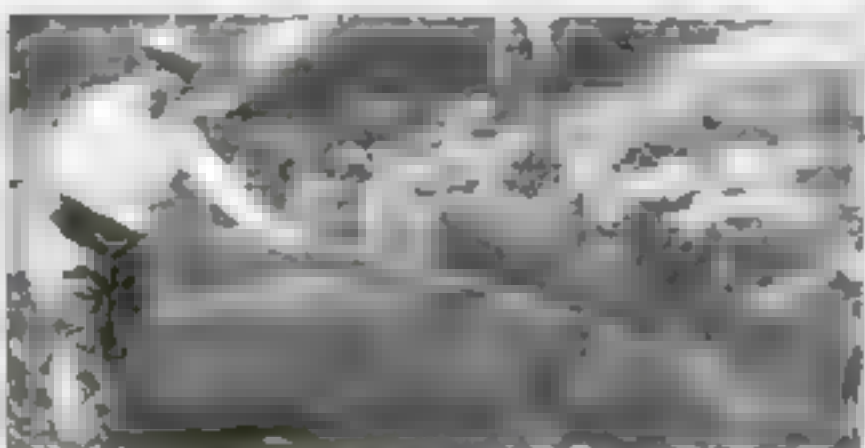
Exquisite Work



Crippled Artist Creates Marvelous Figures in Sand

On the sands of San Francisco's Ocean Beach, Ernest Woods, a sculptor minus both legs, recently has been creating a series of beautiful studies. The above picture shows the crippled artist and his dog, with one of his creations of sand.

A Club for Retrieving Golf Balls



CAPTAIN C. L. MIDDLETON, of Washington, D. C., has invented a novel device that he calls a "fisher for golf balls," a replica scoop at the end of a handle with holes in the bottom to let the water run out. This handle is telescopic and when collapsed is but little longer than a golf club. In general appearance the golf "fisher" looks like a driver or brassie and may be carried in one's golf bag with other clubs. The picture at the left shows the "fisher" collapsed. The man on the right is retrieving his ball from a water hazard.

This tie case holds and presses four scarfs, and it can be folded to the size of a neat pocketbook.



A Convenient New Case for Pressing Your Ties

THE London man of fashion is keeping his ties smooth with this new tie press, which soon will be introduced in America. A small piece of card board is inserted in each tie, keeping it stretched in shape while not worn. There are four pockets in the case holding four ties. The case may be folded to pocketbook shape.

Bicycle Pump Used to "Break in" Pipes

AN INGENIOUS English tobaccoist employs an ordinary bicycle pump to "break in" new pipes for his customers. After the pipe is loaded the stem is connected with the pump, the light is applied, and the pump handle worked slowly until the tobacco is consumed. The pipe then is laid aside to cool, and the process is repeated. The taste of the weed is thus destroyed.

To Protect Your Baby's Bottle

THE inventor of the "baby bottle protector" which is shown at the right, is Mr. Joseph McCrink of Newark, N. J. This device, made of one piece of rubber, can be put on or taken off in a few seconds. The ribs of the protector make it easy for a child to hold the bottle, or they also can be used to tie the bottle to the crib.



Germany Produces Sheet Steel as Transparent as Glass

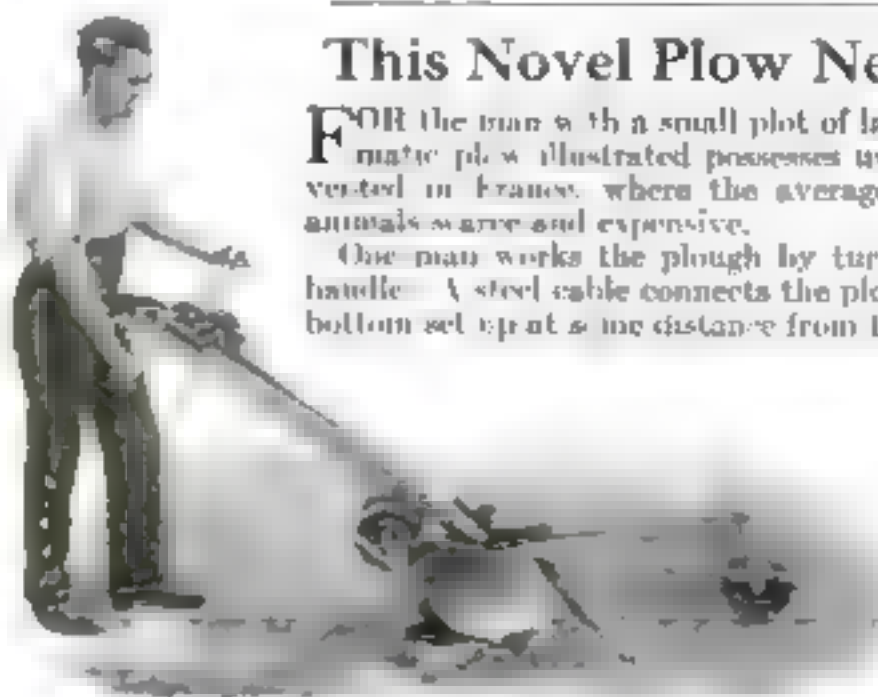
SHEETS of steel so thin that they are transparent recently were produced by Dr. Karl Mueller of the Technical Institute of Berlin, Germany. The test plates used to determine the transparency of optical glass, and ruled with lines one twenty-five hundredth of an inch apart, were photographed through such a metal sheet. When enlarged to four hundred diameters, the scale lines showed distinctly, without distortion.



A Flashlight Lantern for Awkward Places

FOR awkward jobs in obscure places, where the old-time flickering lantern once was used, a new flashlight lantern has been designed. It stands on its own base and projects a constant, steady light on any spot, leaving the workman's hands entirely free for work.

A handle forms part of the lantern so that it can be hung on a nail or suspended from the workman's belt. It was designed for general use around the house as well as for motorists. The light uses three standard unit cell batteries.



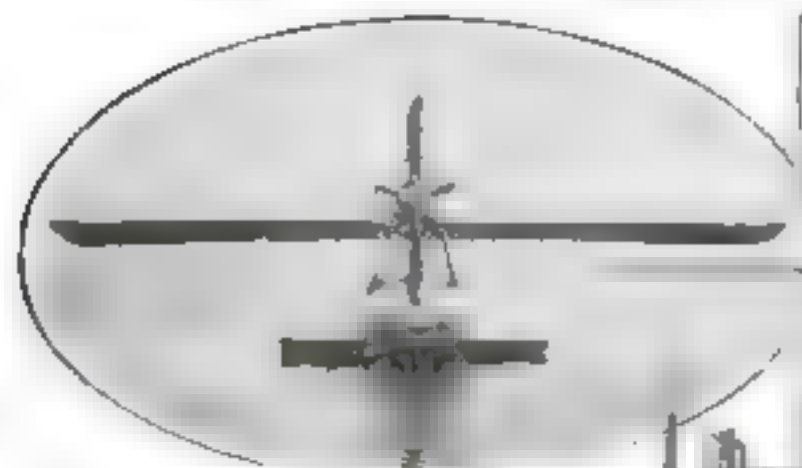
The man in the above illustration is demonstrating the latest automatic plow that has been invented for the small hard farm field.

How Much Do YOU Know about Science?

THE following questions were selected from hundreds that daily are received by *POPULAR SCIENCE MONTHLY*. How many of them can you answer? They concern facts of the world in which we live. After you have tested your knowledge of things we should all know, turn to page 158 to discover how many of the 12 questions you were able to answer correctly.

1. Are the winters more severe than they used to be?
2. Why does pepper burn the tongue and not other parts of the body?
3. What is the advantage in having two eyes?
4. How can we use the Big Trees in California to determine the climate in the time of Christ?
5. Why is it that the ostrich cannot fly?
6. Can we see all of the moon?
7. What is ozone?
8. Why does a silver spoon help to prevent a glass from cracking when hot liquids are poured into it?
9. Why are some parts of the earth desert?
10. Is there a sea serpent?
11. Why does paint keep iron from rusting?
12. Why does cold make us shiver?

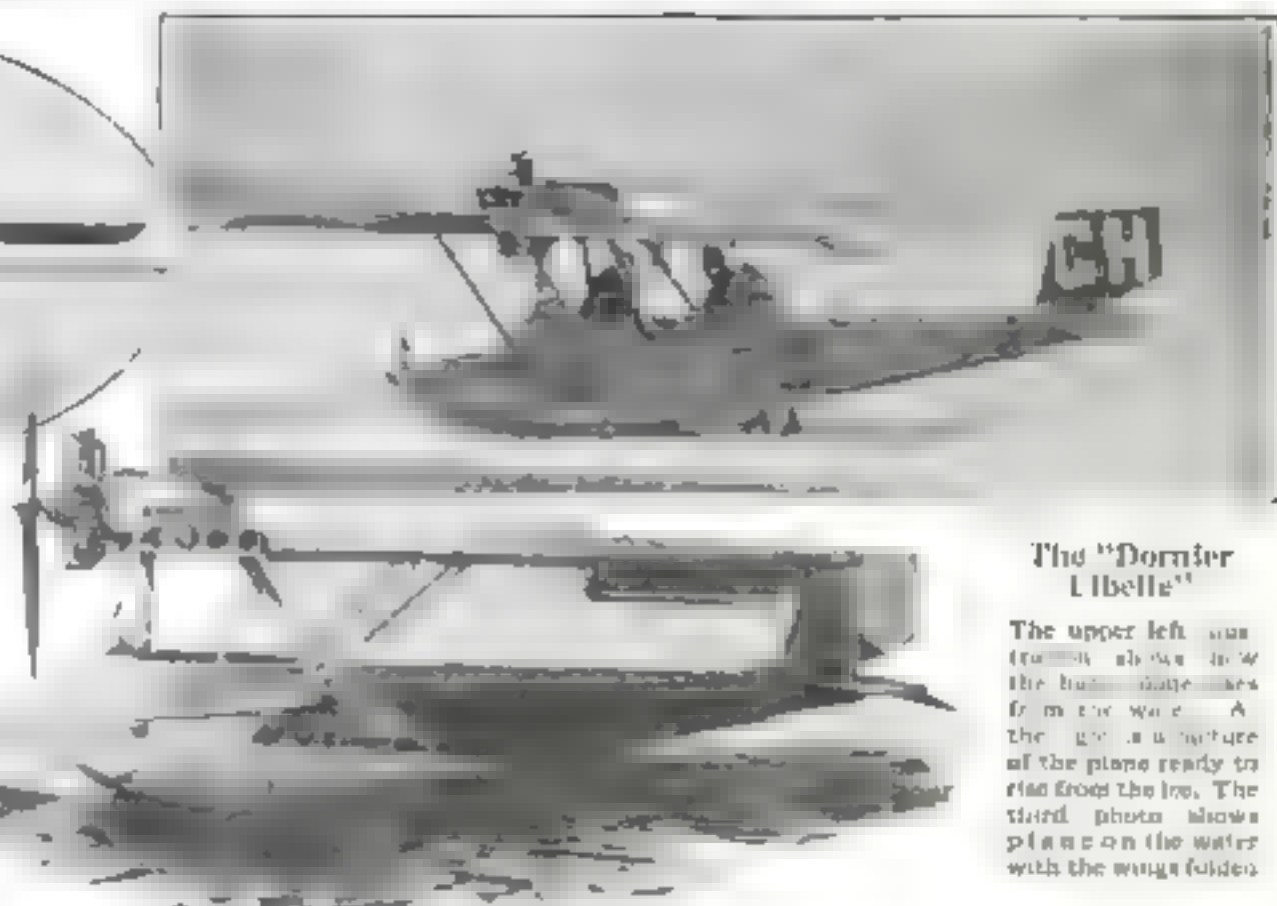
New Plane Takes Off from Land, Ice, or Water



A BOAT that will fly from land, water or ice! Twenty years ago such a thing was a dream. Today it is a reality.

It is so rapidly becoming a reality that in the last 40 years, there is a boat has been built and such a boat actually was put in operation recently in the Great Lakes region. It is a 60-horsepower all-steel flying boat, with space for three passengers.

This machine, which is called the *Dornier Libelle*, is said to be the only plane that can land on ice or water without the aid of skis. When used on ice or water, its wings fold back, lessening the resistance. It is narrow enough in this



The "Dornier Libelle"

The upper left view from above shows how the machine takes from the water. A third photo shows the plane ready to rise from the ice. The third photo shows the plane on the water with the wings folded.

wingless condition to fit into an ordinary moderate sized motor boat shed.

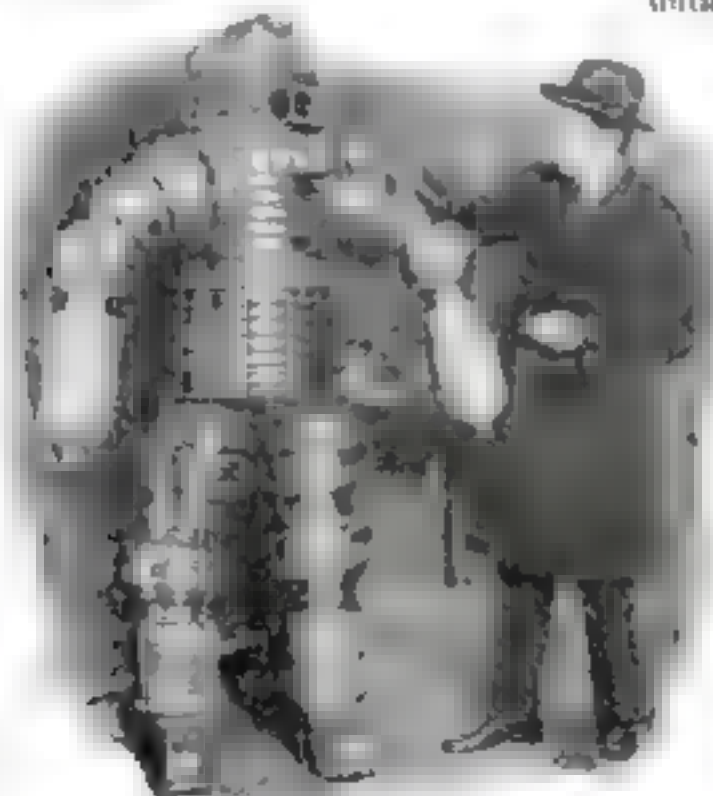
A boat like this that can alight on and fly from ice as well as land is a means of saving islands in the Great Lakes region from dangerous isolation in the winter.

Previously, forced landings of hydroplanes on ice invited disaster. In the February, 1925, issue of *POPULAR SCIENCE MONTHLY*, an interesting story was told of how Uncle Sam's postal service keeps in touch with these islands.

ELEPHANT grass and bamboo are used for the manufacture of paper in India, where there is a scarcity of wood and consequently of the more usual pulp material.

New Rustless Diving Suit

A N ENGLISH inventor, Mr. J. S. Percuss of Byfleet, recently sent to the Shipping Exhibition, at Olympia, London, England, his newest invention, a rustless diving suit. It is made of rustless steel that guarantees, it is said, the free play of the joints at all times. The device was given a severe pressure test at the hands of experts. It is claimed that the new steel suit can be used at a depth of 650 feet.



The latest diving device

Insulated Fuse Puller

"SAFETY first" when you go to the fuse box, either to pull out or replace a fuse, will have you use a tool instead of your fingers. The new fuse puller illustrated is made of horn fiber and grips the fuse tightly until it is in



place. It comes in two sizes, one pocket size made in five leaves, and a giant size, seven-layered, with extra large capacity. The small size may be used for fuses up to 100 amperes and the giant size up to 400.

How Colder Water Guides Salmon

THE mystery of how salmon find their way year after year to their spawning ground, is believed to have been solved recently. Professor Henry B. Ward, of the University of Illinois, who has made an intensive study of salmon, discovered that temperature plays a large part in the fish's life. When it comes to a stream junction, the red or sockeye salmon, he says, moving against the current, always select the colder water.

Know Your Car

THE generator that supplies the electric current needed for the lights, ignition, and starter should be regulated to suit the driving habits of the man who owns the car.

The amount of current you need for keeping your battery charged properly depends entirely on the treatment the car receives. One owner may use his car for short runs with much stopping and starting of the motor, and he may drive mostly at night when lights are required. Another may use his car only for long runs during the daytime. The first requires a higher generator output to keep his battery charged than does the second individual. The time of year and the climate also must be considered.

To adjust your generator properly, follow these rules.

1. Move third brush to increase output if hydrometer reading of battery does not show at least 1280 most of the time.
2. Reduce the output if battery uses too much water. It should not be necessary to add water oftener than once in two weeks.
3. Reduce the output by half when you go on tours in summer.
4. Increase the output in cold weather. Your starter takes more current when the motor is cold.
5. Don't forget to clean the commutator occasionally. Gasoline on a rag will help remove the fouling.

Curious and Useful New Inventions



A Bullet-Proof Shield for the Police

IN THE olden days, knights with their heavy shields weren't half as well protected as Chicago police today with the unique device illustrated above. This new bullet-proof shield fastens around the neck, leaving both hands free, and a large lens allows full vision.

In a tight place, once having cornered a criminal, police have been at a great disadvantage. When routed from their hiding places, criminals will shoot to kill the pursuing policemen.

Every police station in Chicago, it is said, will be equipped with the new shields, and they will go out with tear gas as a necessary part of a policeman's fighting equipment.

Want More Helium

THE United States is the only country that has helium in large quantities. Germany is considering a suggestion that helium can be derived from manure gas, which now is made into gas marbles.

From 15,000 to 20,000 cubic feet of gas, it is estimated, could be recovered from the manure in a year, which is at least as much as was lost in the *Sandwich* disaster. This amount of helium would suffice for technical purposes, though not for the needs of dirigibles.

Look Out, Boys, for the Electrical Spanker!

JUDGING by the number of boys who visited the recent Electrical Show in New York City, the youths of the country are warmly interested in modern inventions. However, there was one exhibit that was not at all popular with the smaller boys. It was an electric spanking machine. The illustration shows how it operates, and we are waiting to hear if some community has bought one for its youthful wrong-doers.

Something New in Men's Wear—a "Dickey Vest"

IF HE should forget and take off his coat, that would give him away, and some rude person might laugh. For the man in the illustration at the right is wearing the latest in men's wear—a backless vest. It is very economical, requiring only material for the front, which is held in place by a belt around the waist and a strap back of the collar. It slips over the head and buttons at the back. Another advantage of the dickey—a man can take off this kind of vest without first removing his coat.



New Zworkin Tube Starts Washing Machine

THE inventor of the Zworkin thermionic photo-electric tube is A. K. Zworkin, who fled from Russia after the war to escape the Bolsheviks. The tube is said to be a new wonder of this scientific age. Mr. Zworkin, it is claimed, is the first man to combine the photo-electric cell with the vacuum tube as an amplifier for practical purposes. At the recent Electrical Exposition held in New York he demonstrated the practical possibilities of his new tube, based on the mechanical power of light rays, by starting a washing machine.

Mr. Zworkin's device consists of a radio tube of a highly special character, an ordinary direct current, and an automobile headlight. By concentrating the light from the headlight upon the tube, an electric current flows through the plate or telephone circuit of the tube, which holds open a switch in the bell circuit. The current in the tube's plate circuit decreases instantly if there is the slightest interference in the intensity of the illumination of the tube, such as is caused by the passing of the hand in front of the tube or the shadow formed by a whiff of cigarette smoke.



The tube shown in the illustration below is demonstrating one of the latest devices for a well equipped home—an electrical spanker, which spans the hand but effectively improves the young culprit.



Bright Plumage Is Birds' Protection

NOW comes a scientist who says that a male bird's gorgeous coloring serves the very utilitarian purpose of protecting him from his enemies.

At first thought the idea of bright colors protecting a bird seems ridiculous, but Dr. Austin H. Clark of the U. S. National Museum, says, "You must remember the bird's eye. It's not like a person's eye. It has a much shorter focus, so that things look practically all in a single plane, without depth."

"To a bird, a landscape looks like a patchwork of light and dark pieces, each sharp and distinct. Against such a background, an object is least observed if it is bright. The gay plumage of the male affords protection from enemies of the air."

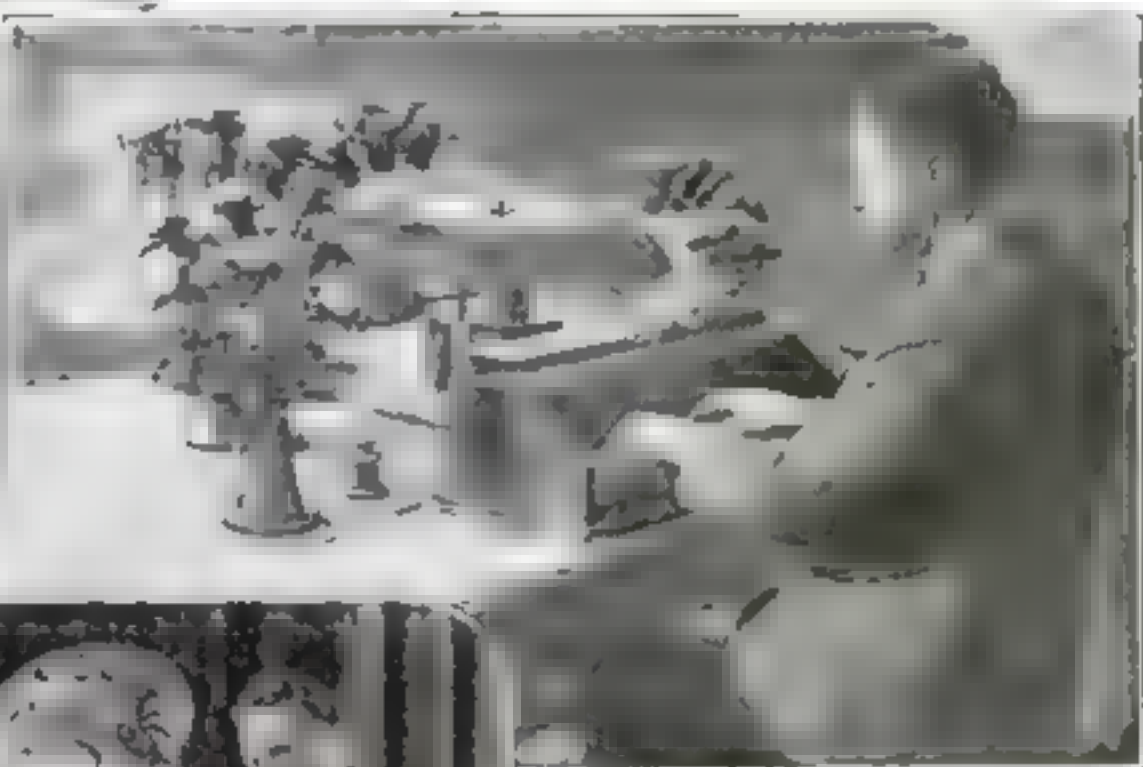
Strange Sources of Music



Five Feet of Melody

The above photo shows Miss Una Fleming, of Los Angeles, Calif., with her five-foot ukulele, the largest instrument of its type on record. Miss Fleming, who is called the "Original Ukulele Lady" recently traveled to Hawaii with this huge musical instrument, where she no doubt found "Say It With a Ukulele" as good a way as any of conversing with the natives.

An Amazing Instrument
That Plays Music with
Beams of Light



A luminophone, an instrument that produces music by beams of light, is the latest invention of H. Grindell Manfrew, who is shown with his device in the picture above. The luminophone has a keyboard of 32 notes, which release light beams from projectors, and these pass through perforations in revolving disks. The interrupted light rays hit selenium cells and are changed into electrical vibrations. The vibrations are magnified by a tube amplifier, just as in radio, and issue forth from a loudspeaker.

He Is a Whole Jazz Band in Himself



A One-Man Orchestra

Henri Kublick, a Chicago vaudeville artist, doesn't care much whether the musicians' union goes on a strike or not. At his finger tips he has a whole string orchestra—banjo, harp, piano, guitar and mandolin. The strange instrument giving all these effects, called a "banjochestron," is his own idea and was made under his personal direction.

A Tiny Pipe in Los Angeles Organ

A monster organ was built some time ago at Los Angeles, Calif. The largest pipe is 32 feet long and three feet square at the big end. Our illustration at the left shows the smallest pipe in this instrument—a pipe with a speaking length of not over three eighths of an inch and a diameter but a little larger than a straw.



Stacy specializes in wandering musicians who play half a dozen instruments at the same time. The above picture shows a one-man band of Teorina. Observe how this itinerant artist uses his whole body. A toss of his head starts bells a tinkling, a stamp of his foot booms a big drum. With his mouth he plays pipes; his hands play an accordion and he has drums and a cymbal.

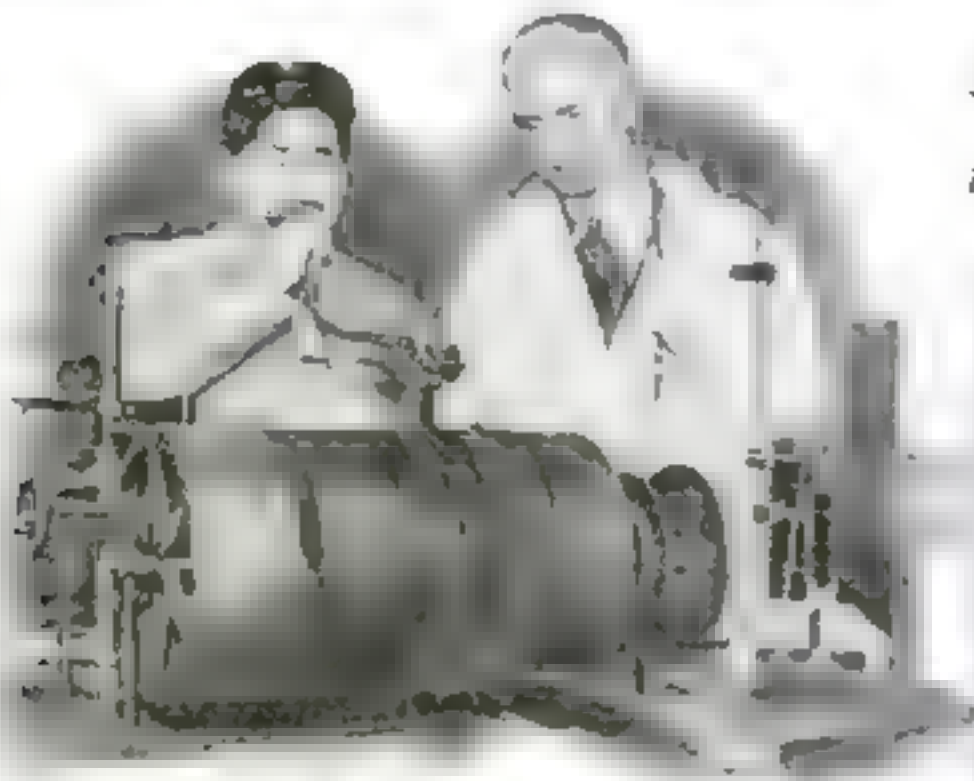
"Singing Coconut" Is on the Way from Hawaii



Is the ukulele to give way to the *nju kani*, a new musical instrument from Hawaii? The sounding box is made of the polished shells of coconuts from the islands of Oahu and Kauai. Preparations are being made to turn out the "singing coconuts," as they are nicknamed, at the rate of 50,000 a year. David Kalawa, a foreman in a Honolulu music factory, is shown with three of the finished instruments and also the coconuts from which they are made.

Automatic Signal Robs Fog of Its

*New Advances Made by Science
in the Conquest of Ignorance*



A Novel Device to Learn English Sounds

In the above picture Prof. Duguid is shown with the instrument at University of Edinburgh. This is a new device for teaching English sounds to foreigners. It is a small, portable, and efficient instrument.

Scientific knowledge is probably the most valuable conquest of the human mind because its discoveries invariably lead to practical applications that promote the happiness and comfort of us all. Each month we aim to give you in these columns the latest practical results of the newest scientific discoveries. By reading these pages you can keep abreast of the world's achievements.

FOG creeps up the Irish Channel. It grows denser. Then suddenly from a lighthouse comes the blaring, mournful blast of a foghorn. At regular intervals the warning is repeated.

If you climb up into this lighthouse in Dublin, Ireland, you will see no one, for the warning is automatic. The fog itself sets the signal going. This remarkable device is the invention of a young professor of the National University of Ireland—J. J. Dowling.

A huge lamp sends a strong beam of light slanting across the channel onto a large window in the lighthouse. This window lens concentrates the light on a light sensitive cell inside the lighthouse, producing an electrical effect that is magnified so that it operates an electrical relay. When the light beam is dimmed by fog, the relay current reverses, closing an electrical circuit that starts the foghorn.

Ships going by, birds, airplanes, or other passing shadows have no effect on the signal. Only persistent weakening of the light by fog operates the signal. The apparatus requires no attention, and for a year has operated successfully.

Serum for Broken Bones

BREAKING an arm, a leg, or even a hip may not be so serious an accident within a year or two. Healing broken bones of young persons may be hastened and the fractured bones of even old persons will knit together if the patient is

treated with a certain glandular extract, according to the indications of recent experiments in Japan.

Next to the thyroid gland in the neck are four tiny glands known as "parathyroid glands." An extract from these, when swallowed or injected, causes the percentage of calcium and phosphate in blood serum to rise, it is claimed. Large quantities of both these chemicals are needed in bone building. One reason why bones usually heal very slowly is because it takes a long time to extract enough of these substances from the blood.

Doctor Ogawa, a Japanese surgeon, recently has been experimenting with parathyroid extract in the Japanese medical academy of Keijo. He found that rats fed with the extract grew twice as much new bone as those not treated with it. It now is being tried out on human beings, and the results so far have encouraged the belief that the long weeks of wearing bandages and plaster casts may be greatly shortened.

A Fishing Thermometer

THE wise fisherman of the future will test the temperature of the water in which he casts his lines.

The Biological Board of Canada, after a detailed oceanographic survey, has found that haddock and cod, especially, are very particular about temperature. The cod will not stay where the water is freezing, and for him 30 degrees is unbearably hot. Between 40 and 45 degrees is about right, and if fishermen will fish there, it is claimed, they can scoop cod up wholesale. Haddock like water about five degrees warmer. The Board urges fishermen to use deep-sea thermometers and not waste time where there are no fish.



Measures the Movement of a Brick Wall

The U. S. Bureau of Standards has perfected a device that shows the deflection of a 40 inch brick wall under the slightest pressure. Above: J. E. Merrill is observing the deflection caused by the pressure of one finger. If you look into the eyepiece of this sensitive instrument while some one walks across the floor, the whole building seems to sway.

New Sugar Values

WHEN the average man thinks of sugar he thinks of the sugar used to sweeten his tea or coffee. To the chemist the word "sugar" has no more limited connotation than the word "alcohol." To him "alcohol" may mean wood alcohol or grain alcohol or propyl alcohol or butyl alcohol, or dozens of other alcohols—all of them substances that, in one way or another, are related sufficiently to be grouped under one division. Sugar may mean cane sugar or grape sugar or fruit sugar or milk sugar, or dozens of other sugars, all of them related more or less.

All sugars are more or less sweet; that is one of their most characteristic properties, though none of them even distantly approaches saccharine in sweetness.

Saccharine, which is several hundred times as sweet as any of the sugars, is not a sugar at all, but is obtained from working up coal tar. Despite its much greater sweetness, few of us ever use saccharine, because the body derives no heat value from it. But in dealing with sugar, no matter what the sugar is, we deal with a substance that is really a very valuable food.

The average weekly consumption of sugar is about two pounds, representing some 8000 calories in food value. Several professors at the University of Minnesota have just published a method for determining the relative sweetness of the various sugars, and they find that if the sweetness of cane sugar be represented by 100, fruit sugar becomes 173, grape sugar 74, and milk sugar 16.

Many Dangers

The interesting discovery is now made that fruit sugar, found in many fruits and particularly in honey, is more than $1\frac{1}{4}$ times as sweet as our ordinary table sugar. As might be expected, several enterprising manufacturers are already dreaming of a profitable market for fruit sugar.

A Quart a Day

MILK, we have been told of late years, is one of the most valuable of foods; most valuable because, more than any other food, it contains the elements so necessary to life and wellbeing. Relatively few of us, despite this view, seem to drink enough of it. Professor Sherman, of Columbia University, who probably knows more about milk than any other person living, has come to this important conclusion: children from the days of infancy to the ages of 14 or 15 should never receive less than a quart of milk each day if they are to grow to vigorous manhood; "and," he adds significantly enough, in his report to the World's Dairy Congress, "the quart a day had better be extended to all ages."

How We Rank

IN SCIENCE we are trailing along at the tail end of the parade, says Secretary of Commerce Herbert Hoover. In industrial research, applying known scientific facts, we are at the front with the best of them, but we fall behind when it comes to discovering basic facts for ourselves.

"Instead of leading all other countries in the advancement of fundamental scientific knowledge," he says, "the United States occupies a position far in the rear of the majority of European nations. A list of the awards of the Nobel prizes to men of various nationalities reveals the small proportion of first prizes that we support. Other tests lead to the same conclusion, namely, that the number of first rank investigators developed in the United States is far below what our population, education, and wealth would lead one to expect."

The money set aside for research in pure science in this country is less than \$10,000,000, one-tenth of what we spend on armaments. Secretary Hoover terms this "absurdly small." Any one reading the list of Nobel prize winners below will be inclined to agree with Mr. Hoover and undoubtedly will be surprised to find that even little Holland, Belgium, and Denmark are ahead of the United States.

The Nobel Prize is by far the highest honor that can come to a man of science. It is a recognition that

he belongs to the class of immortals. Professor van Klooster, of the Rensselaer Polytechnic in Troy, has classified the Nobel Prize winners in chemistry, physics, and medicine according to the country from which they hail; and he finds that Germany heads the list with 24; then follow in order France (12), England (11), Holland (6), United States (4), Denmark (3), Sweden (3), Switzerland (2), Canada (2), Belgium (1), Spain (1), Italy (1), and Russia (1).

Iron Necessary to Life

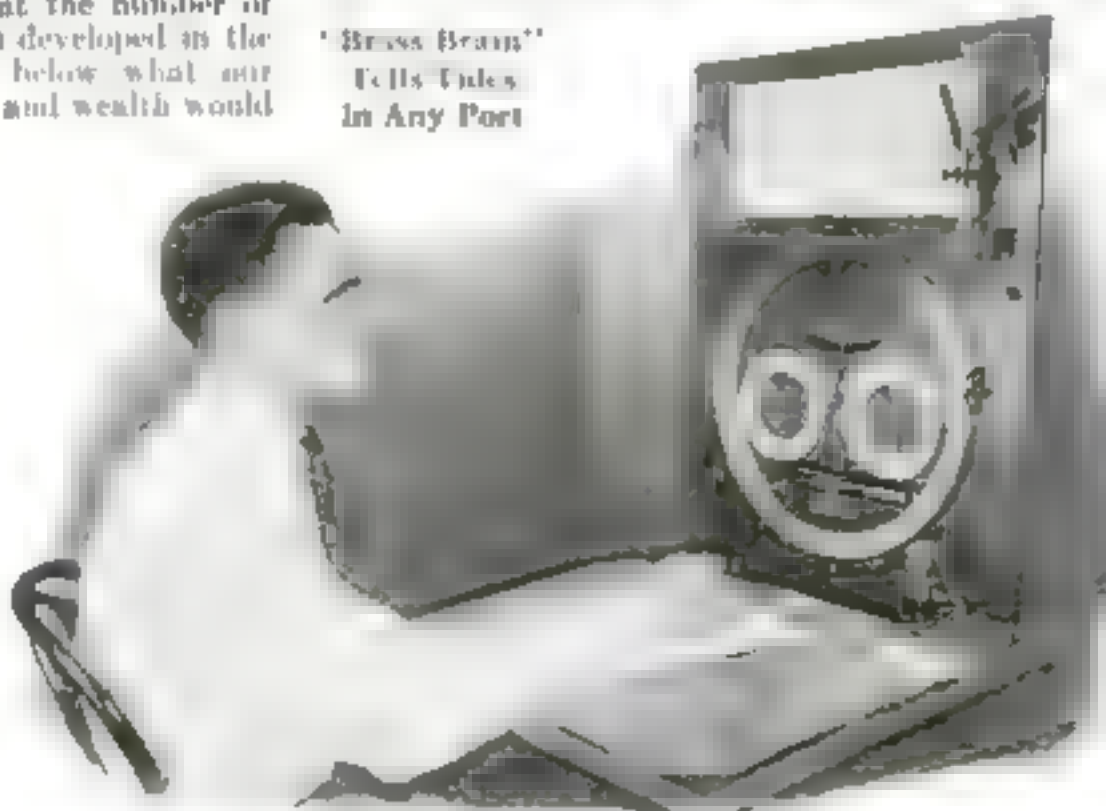
AT THE mention of the word "iron"

most people immediately think of the tons and tons of iron ore in the Northwest, of the tons and tons of coal in Pennsylvania, of how the iron ore and coal are brought together to give us iron and steel and the kind of world we live in today.

We seldom think of a form of iron that we human beings and all animals must have if we are to live at all, and yet, whenever a man cuts himself in shaving, he sees a red liquid that owes its color to the fact that it contains iron. This red liquid, this hemoglobin, this iron-containing compound is as necessary to life as the very air we breathe.

When we have too little of this precious fluid, we become pale, and the doctor refers to us as "anemic." He used to

"Bress Brain"
Tells Tides
In Any Port



In the laboratory of the Coast and Geodetic Survey at Washington there is in constant use a device said to do the work of 50 mathematicians, called the "Bress Brain." This machine can predict what the tides will be in any seaport in the world at any time—tomorrow or a 100 years from tomorrow. Its predictions have proved to be nearly 100 per cent perfect in the daily use to which it now is being put in Washington.



These Pampered Germs Require Dainty Dishes

In the laboratories of the U. S. Department of Agriculture certain rare germs are propagated for experimental purposes. They have to be fed with foods that contain egg elements, alcohol, etc. A special chef concocts their dainty dishes. In the photograph Chef William Garrett is making beef tea for these pampered parasites.

give us tonics containing iron, in the hope that the latter might take the place of the missing iron in the body. But it is interesting and important to note from the most recent studies by eminent American physicians and food chemists, that less and less stock is being placed in tonics containing iron and more and more in foods containing iron. The specialists tell us that the yolk of egg, beans, wheat, beef, nuts, prunes, and spinach are among the foods rich in iron.

"Skim Milk" Products

WHEN you remove cream or butter fat from milk, so that butter and ice cream may be manufactured, you have left what is known as "skim milk." At present, something like \$2,000 million pounds of skim milk are produced annually in this country. Until recently this enormous quantity of material was considered little less of a waste than at one time was the coal tar, out of which we now get all the dyes and drugs on the market.

Skim milk contains, among other things, casein, a protein and a valuable food. This same casein is now being put to some remarkable industrial uses. It is used for coating paper, for making glue, for making paints, in the printing of wallpaper and fabrics, and in the manufacture of a substitute for horn, celluloid, and hard rubber.

NIPCE, who is known as the father of photography, made his first camera from a cigar box and lenses borrowed from his grandfather's solar microscope.

They Lighten

New Ways in Which Alert

From Novel Broom-Mops



Self-Service Whisk Broom

With the whisk broom shown above you can brush your own car without a man. The broom is self-sufficient in that it has a long handle and a long neck. The broom is also self-sufficient in that it has a long handle and a long neck.



This Chopper Fits the Bowl

Some choppers are too small for your bowl. This one is just the right size. It is made of wood and has a long handle. It is also self-sufficient in that it has a long handle and a long neck.

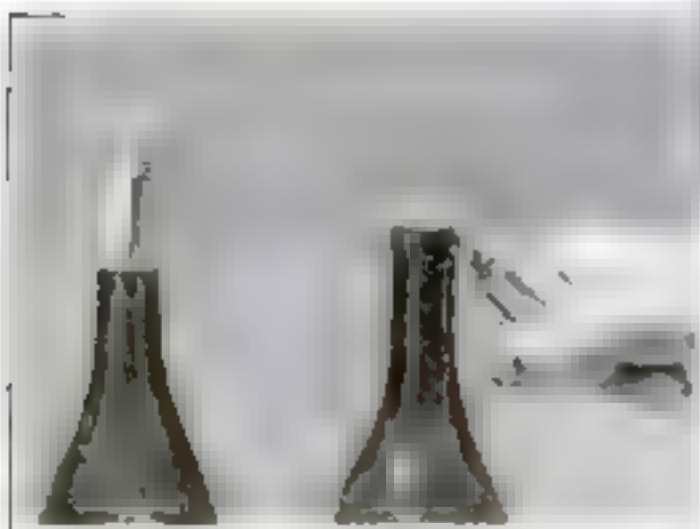
Makes the "Real" Marcel

A real Marcel is the one that is made of wood and has a long handle. It is also self-sufficient in that it has a long handle and a long neck. The broom is also self-sufficient in that it has a long handle and a long neck.



No Paraffin for this Preserve Jar

No paraffin is needed for this jar. It is made of wood and has a long handle. It is also self-sufficient in that it has a long handle and a long neck. The broom is also self-sufficient in that it has a long handle and a long neck.

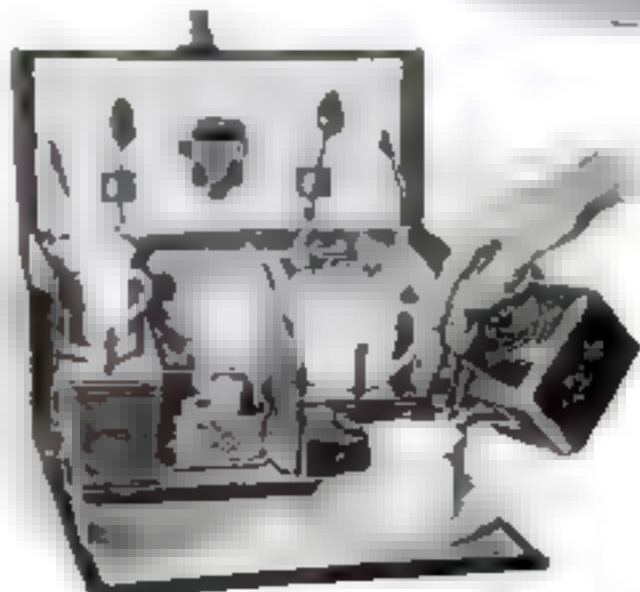


It Seals and Opens Bottles

This opener and sealer is the one that is made of wood and has a long handle. It is also self-sufficient in that it has a long handle and a long neck. The broom is also self-sufficient in that it has a long handle and a long neck.

For Crushing Ice

If you ever have tried to crush ice with a hammer, you know it is a heavy job. This device is for crushing ice. It is made of wood and has a long handle. It is also self-sufficient in that it has a long handle and a long neck.



An Auto Tea for Two

Every thing needed for tea for two is contained in this auto tea set. It is made of wood and has a long handle. It is also self-sufficient in that it has a long handle and a long neck.



Woman's Job

Homemakers Cut Drudgery, to Self-Stirring Teapots

No Specks in this Milk

Keeping dust out of milk bottles is no small problem in these days of soft coal fueling. One solution is this new bottle top. It fits the neck of any milk bottle and makes an airtight cover. To open it, you press the spring lightly with the thumb



More Space in the Icebox

The pans shown above are intended for refrigerator use. The manufacturer has devised a square aluminum pan with a flat lid, because this type of utensil takes up the minimum amount of room in an icebox, and it is claimed, greatly eliminates the danger of spilling food in the refrigerator.

Novel Lemon Squeezer for the Tea Table

If you prefer lemon to cream with your tea, you will appreciate the novel individual lemon squeezer at the left. It will help keep your fingers from getting unnecessarily sticky, and save the tea napkins from lemon juice stains.



Mop or Broom—as You Like It

Above is a practical device for converting your broom into a mop. You simply slip the bag over the broom, and one handle thus serves for two implements. This mop has another advantage. When continued use has made it dirty, you can remove the bag and wash it.

A Self-Stirring Teapot

All tea devotees know that tea should be stirred after the leaves have been left to steep. With the ordinary pot, you have to remove the lid and use a spoon. This one has a knob in the lid that does the stirring.



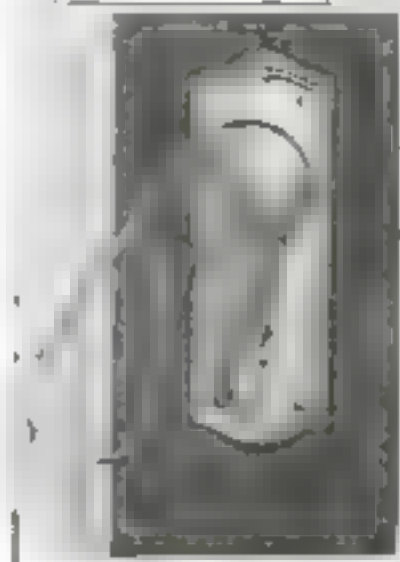
For "Her" of the Bobbed Head

Fashions in bobbed hair have resulted in the invention of an electric safety razor, to enable women to trim the neck quickly and safely.



A Plate to Keep Baby's Food Hot

The baby's food can be kept warm for a considerable time in the attractive plate shown in the above photo. The plate, or dish, fits into a metal container which, in the picture, is being filled with hot water from a kettle. The lid that comes with this handy plate also helps keep the food warm.



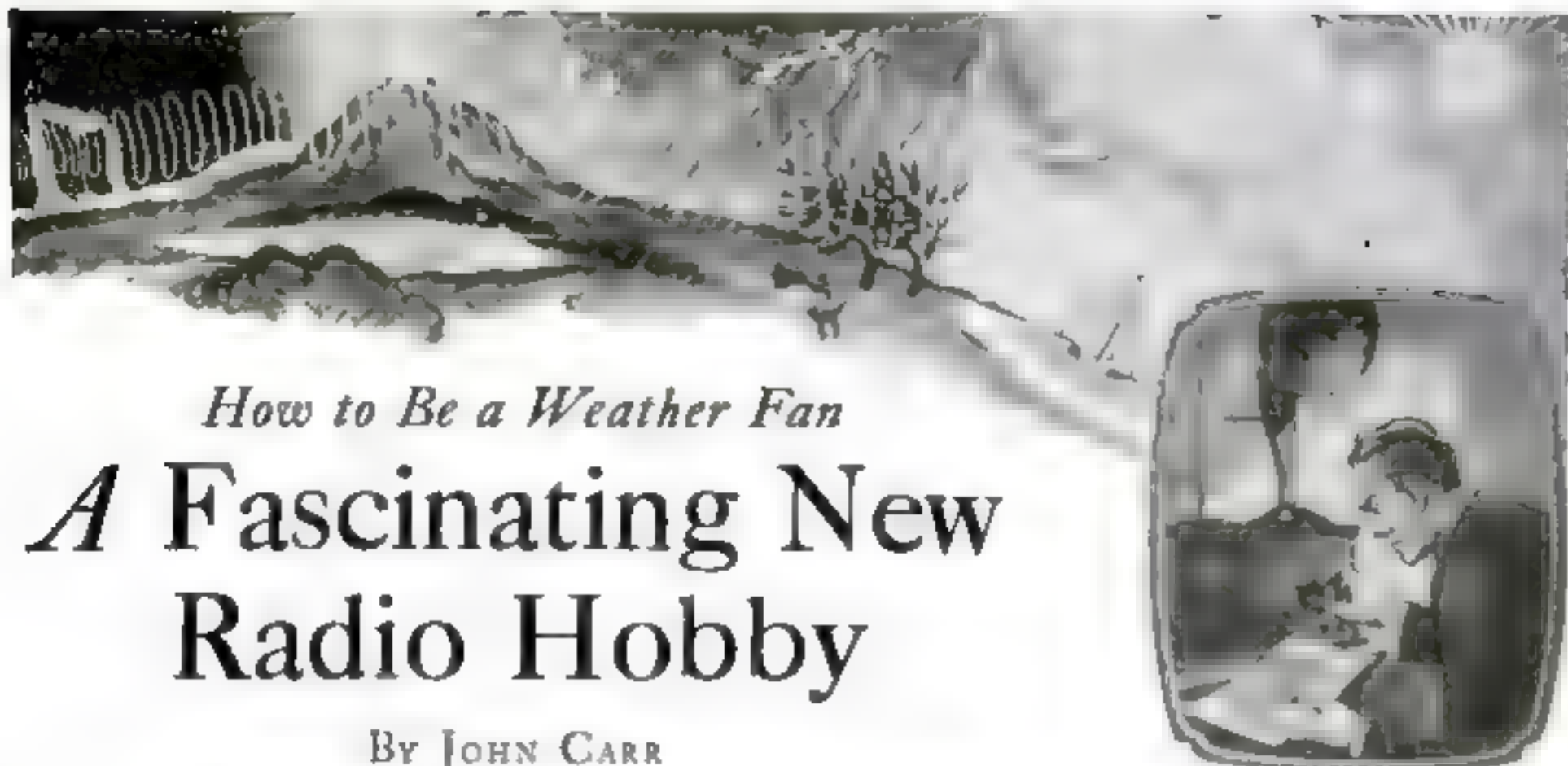
A Cooking Pot that Saves Your Food and Hands

The pot shown above has a base made of nickel-plated steel which not only prevents scorching, but keeps the food warm after turning out the flame. The perforated top prevents boiling over, and you can pour boiling hot liquids out of the pot without even removing the cover.

Thief Can't Pry this Key Away

To the left is pictured a new anti-burglar device. If you slip this little wire contrivance over the door knob, the inventor claims it will prevent burglars from pushing the key out of the lock or turning it while in the keyhole. Photo shows how the device is placed over the door knob.





How to Be a Weather Fan A Fascinating New Radio Hobby

By JOHN CARR

DO YOU still get a thrill when you hear a station a thousand miles away on your radio receiving set? If the hunt for distant stations has begun to bore you, you may get a new "kick" from radio-weather observation.

Hundreds of fans in every part of the country are beginning to manifest interest in efforts to solve one of Nature's most mysterious secrets—the connection between the weather and radio reception.

Why do signals fade out and then reappear with full volume? Why can't you hear a distant station as strongly tonight as you did last night? What causes static, and is there any way to prevent it? Just what has the weather to do with radio reception, anyway?

The search for the answers to these questions is the basis for a fascinating and growing new hobby—one that carries with it the possibility of discoveries of untold value to radio and to science.

The United States Weather Bureau has already been studying weather conditions in connection with radio reception. Several corporations, connected directly or indirectly with the radio industry, also are giving the problem thought. But, of course, its solution requires thousands of individual observations, and it is in supplying these that the individual experimenter and listener-in can participate.

F. M. HERRICK, of Rochester, N. Y., has prepared an analysis of the results of many nights of listening-in and of the relation between prevailing weather conditions, as shown by the United States Weather Bureau reports, and his reception. He has found, apparently, that there is a connection between atmospheric pressure in the areas lying between the broadcasting station and the receiving set. But, Mr. Herrick says, it will take a great deal more observation before definite rules can be formulated to predict with any degree of accuracy the possibilities of reception.

Getting started in this fascinating hobby is exceedingly simple. First you take a sheet of paper and rule it off as shown in the two charts on these pages. Then

you study the afternoon edition of the paper and jot down the necessary information about the temperature, barometric pressure, and the humidity of the air. After that you tune in as many stations as you care to. Each time you hear a station jot down how loud it is, whether there is any fading and anything else that seems unusual about the reception from that particular station, as compared with the reception at other times when you have heard it.

WHEN you decide to shut off your set, paste the weather map clipped from the paper at the bottom of your log sheet. That's all there is to it. No expense at all, unless you happen to take it into your head to be your own weather observer, too, in which case you will need instruments. But, of course, your work can be just as complete and valuable if you depend entirely on the daily paper for observations.

The whole matter of the concerted study of the effect of the weather on radio reception is so new, that as yet no definite arrangements have been made to assemble the reports from radio-weather fans for mass study. It is possible, however, that a department of the United States Weather Bureau will take up this work. If

not a number of radio fans who have been active along these lines may organize an association to carry on the investigations.

In any event, your job as a radio-weather fan will be to keep your log-sheets as accurately and completely as possible and file them away according to date. Then, when arrangements have

When Reception Was Good

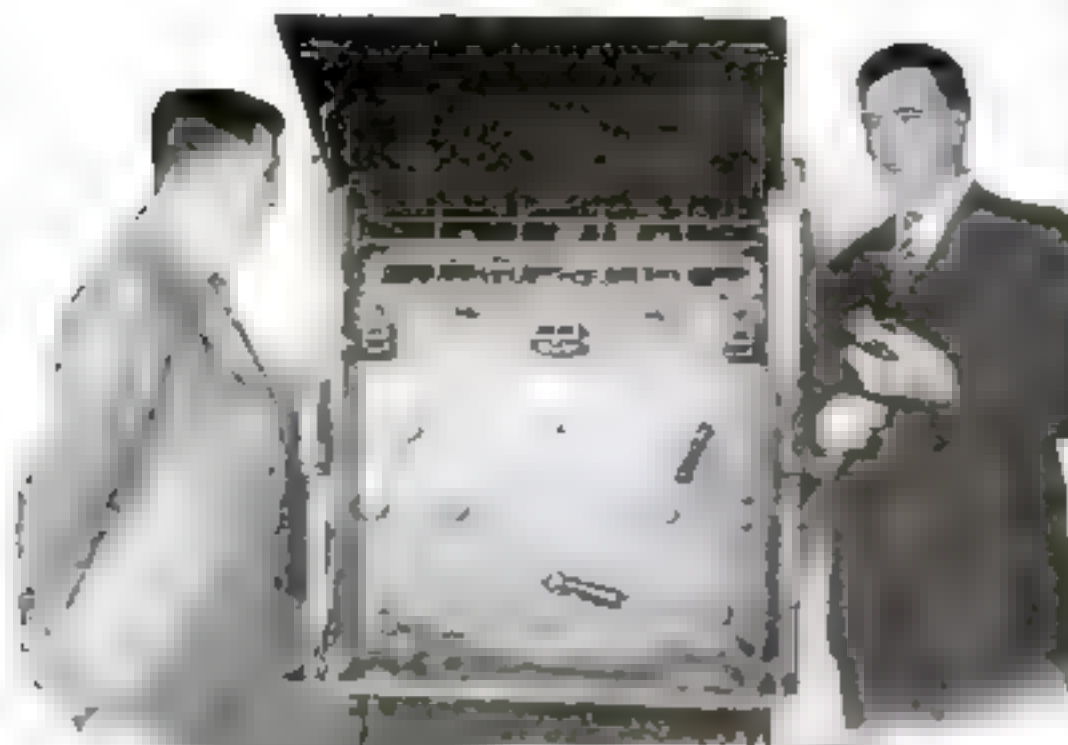
DATE: MARCH 2

City: Chicago State: Ill. Type of set: Ac-coupled

Time: 10:15 Station: 100 feet, 20 feet high

Time	Station	Temperature	Barometer	Humidity	Direction	Speed	Clouds	Wind	Remarks
10:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
10:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
10:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
11:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
11:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
11:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
11:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
12:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
12:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
12:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
12:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
1:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
1:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
1:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
1:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
2:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
2:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
2:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
2:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
3:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
3:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
3:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
3:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
4:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
4:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
4:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
4:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
5:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
5:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
5:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
5:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
6:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
6:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
6:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
6:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
7:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
7:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
7:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
7:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
8:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
8:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
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1:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
1:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
1:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
2:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
2:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
2:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
2:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
3:00	WGN	50	30.1	75	Light	10	Partly	Light	Very good
3:15	WGN	50	30.1	75	Light	10	Partly	Light	Very good
3:30	WGN	50	30.1	75	Light	10	Partly	Light	Very good
3:45	WGN	50	30.1	75	Light	10	Partly	Light	Very good
4:00	WGN	50	30.1	75	Light	10	Partly	Light	

New Products of Radio Genius



New Airplane Radio

The remarkable new type of airplane radio transmitter and receiver is a power of 100 watts and can be used for flight or landing. It has a range of 100 miles for the latter work and a range of 100 miles for the former.

Heard In Every State

Students of the University of California at Berkeley have been able to hear the radio signal from the University of California at Berkeley. The signal was received from the University of California at Berkeley.



Copper Tubing in Huge Variometer

Resembling the ordinary air variable capacitor, but with a much larger range of capacity, this new piece of apparatus is a variable capacitor. It is made of copper tubing, as shown.

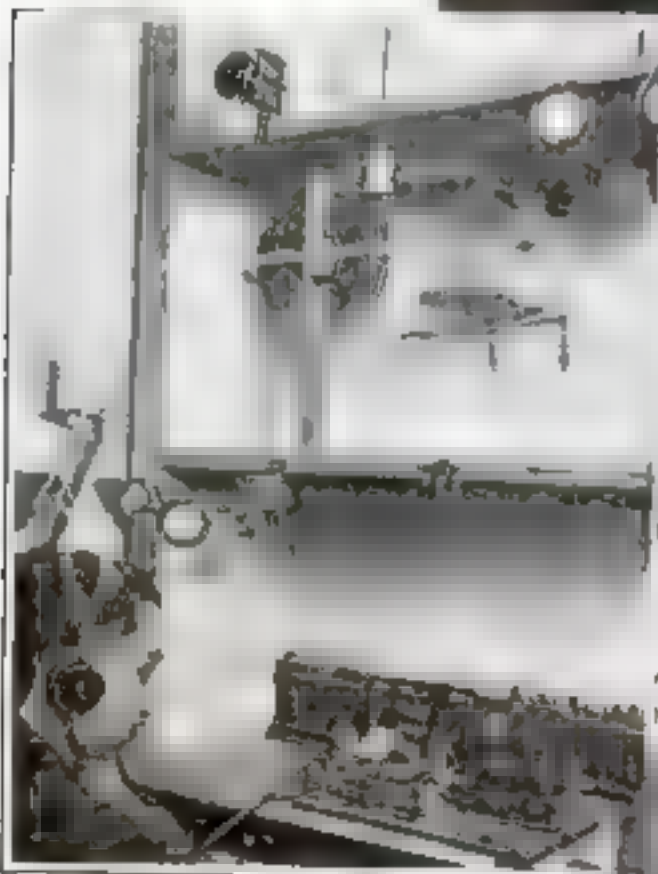


Novel Fittings for Radio Mains

For the radio fan who ever has a difficulty in connecting his radio to the mains, the following novel fittings are shown. They are designed to provide a safe and reliable connection.

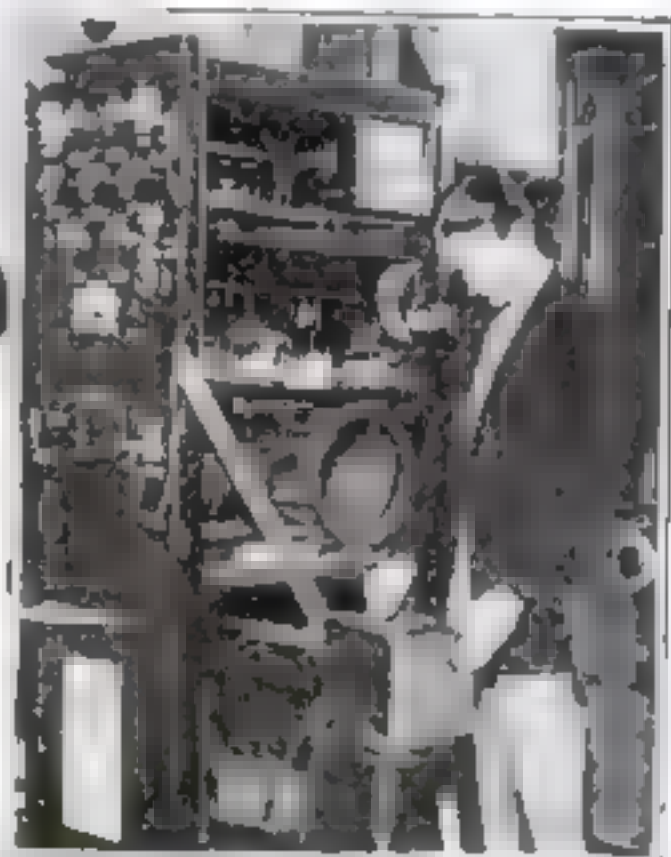
Doorbell Batteries for B Supply

For a safe and reliable supply of B, the following novel batteries are shown. They are designed to provide a safe and reliable supply of B.



Marvelous High Speed Coil Winder

Head phones and loudspeakers are built with coils of very fine wire. The remarkable machine at the right winds the tiny magnet coils with fine wire traveling at the enormous speed of 60 miles an hour without damaging wire or insulation. It operates automatically.



Simple Indicator Tests Broadcast Waves

The radio laboratory of the U. S. Bureau of Standards recently has designed an extremely simple and frequently used indicator for use by transmitting stations. The need for very careful regulation of the wave length is great because when a broadcasting station transmits a wave a few cycles off its assigned frequency, serious interference will be caused. The indicator is a simple device which tests the wave length of a broadcasting station often resulting in a more accurate wave length.

How to Use Radio B Eliminators

Any Wall Plug Will Serve You as Well as a Good Battery

By ALFRED P. LANE

Half a dozen different types of B battery eliminators being prepared for test by the Popular Science Institute of Standards. The Institute tests are rigid and include life tests for the rectifying element, also determination of maximum output, voltage, and absence of hum

THE REMARKABLE progress in the design and manufacture of B battery eliminators now gives you three possible sources of supply for the current to operate the plate circuit of your vacuum tubes. You can use dry cell B batteries, storage B batteries or one of the wonderful new B battery eliminators now on the market—and even the expert can not tell which is being used on your set, so far as results are concerned.

This means that you can substitute a B battery eliminator for the batteries you now are using with it sacrificing either volume or quality. Of course you cannot expect to get better results with a B battery eliminator than you now get with good batteries, for batteries—either dry cell or storage—give perfect current for radio uses. The big advantage of the eliminator that works from your house current is, of course, in cutting out the troubles you now have with run-down dry cells or the constant recharging necessary with a storage type of B battery.

It is entirely possible

to run a one or two tube radio set with a B battery eliminator, but the big advantage of the eliminator comes when it is used with radio receivers having five or more tubes. This is because the larger sets ordinarily require at least 90 volts from the B battery and the current drain is much greater than with the small one or two tube set.

Figure 4 on the next page shows the three sources of high voltage direct current now available. At the left is a standard style of heavy duty, 45 volt dry cell B battery. Two of these in series will run the average five tube radio set for from five to eight months, depending on

the number of hours it is used each day. In the center is a popular type of storage B battery consisting of 24 cells. Two of these batteries in series will give you 90 volts and with care they will last for five years or more. Such a battery requires regular charging at intervals of every two weeks and refilling with distilled water every two or three months. At the right is a typical B battery eliminator. These instruments supply 90 volts or more for the amplifier circuits, and an adjustable voltage for the detector tube.

MANY people cannot see why it is impossible to plug directly into their 110-volt house current to run their radio sets, just as they would for a vacuum cleaner or electric iron, nor do they understand what the B eliminator does to this current to make it usable for radio purposes.

Perhaps the simplest explanation is to point out that the sounds you hear coming from the loudspeaker are reproductions of variations in the electric current

flowing through the coils inside it. And in order to produce recognizable music and speech it is necessary to have a perfectly even flow of current on which to impress these variations. The ordinary 110-volt current supplied to most of our homes is of the alternating type. Instead of being a smooth and constant current it flows back and forth, so that there are usually 60 complete cycles or changes

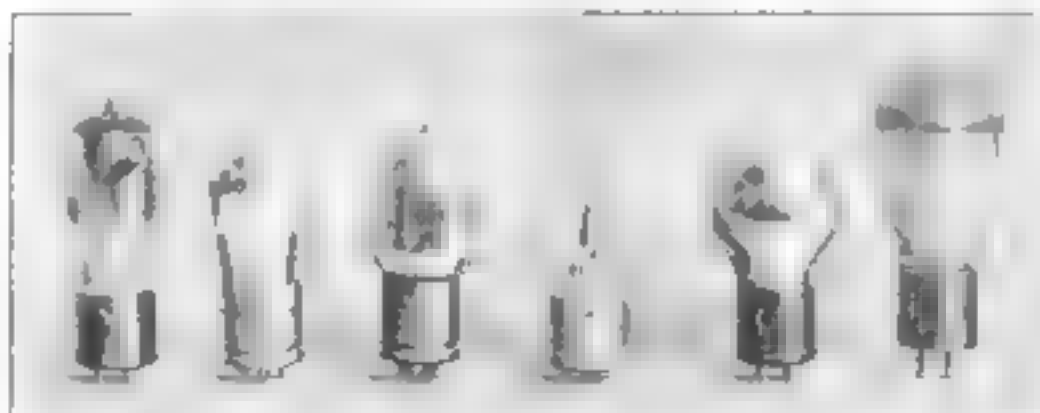


Fig. 1—Six kinds of modern rectifying tubes used in B eliminators. They are of two general types. Some operate by means of a heated filament, others being operated without filament, utilizing the ionization properties of a special gas

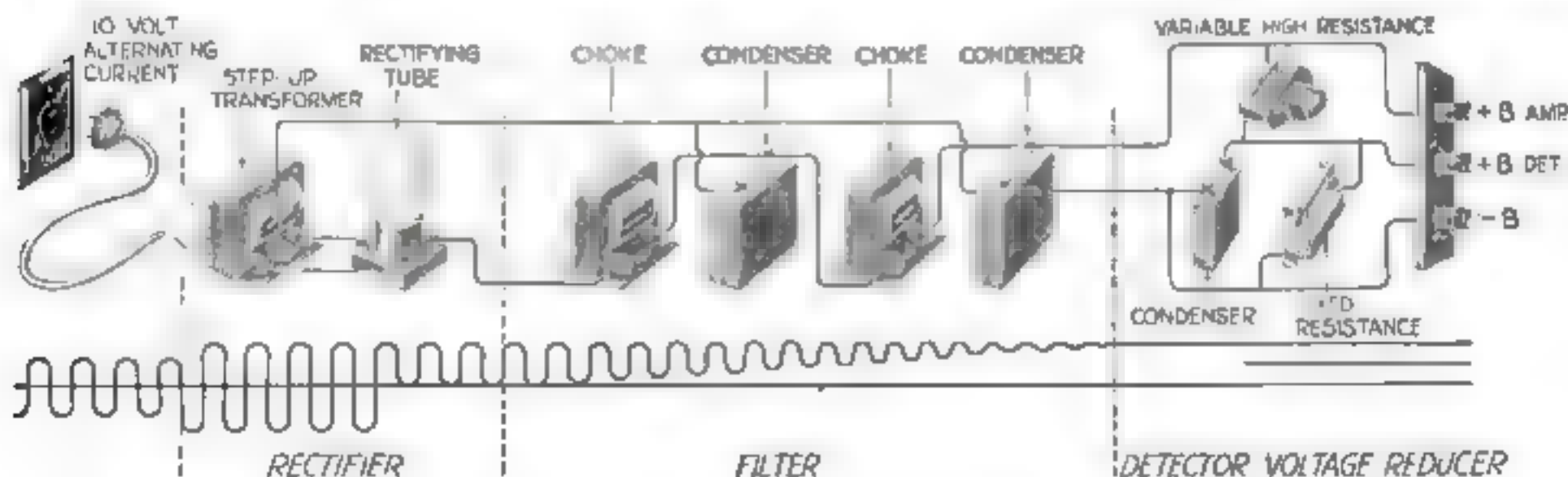


Fig. 2—This diagram shows how the different parts of a B battery eliminator are connected, and their functions in changing the 110 volt alternating house current into a smooth, even supply of direct current

for the radio set. At the bottom of the drawing is a graphic illustration of how the electric current is changed by the rectifier, filter, and voltage reducer. Each manufacturer incorporates his own ideas in this circuit

each second. In other words, each of the supply wires becomes alternately positive and then negative some 60 times a second.

What chance would you have to hear the relatively slight changes produced by the radio signals if they were impressed on a current violently fluctuating from positive to negative? None at all, for the broadcasting would be completely lost in the terrific 60 cycle hum.

The function of the B battery eliminator is, first, to change the alternating supply to a pulsating direct current, and then to smooth out the pulsations so that a perfectly smooth, even supply of direct current is available at the binding posts of the instrument. How this is done by the B battery eliminator is shown in Fig. 2.

YOU will note in Fig. 2 that a graphic representation of what happens to the electric current is shown at the bottom of the drawing. The current flowing out of the electric light plug is shown as a snake-like line indicating the result if the voltage variation were plotted with the straight line representing zero voltage. The first operation in any type of eliminator is to convert this alternating current to a pulsating direct current. Usually the alternating current is stepped up by means of a transformer to a somewhat higher voltage and then it is fed into a special tube that rectifies it, or the rectification is accomplished with electrolytic cells that permit current to flow through them in only one direction.

The next step is to feed this pulsating direct current into a filter system, consisting of a number of very high capacity condensers and one or more choke coils. The function of the choke coils is to resist changes in the rate of flow of the current passing through them without materially interfering with the flow of current that is not changing in amount. In other words, the choke coils act like springs in that they add voltage to the circuit as the supply voltage drops, and subtract voltage as the supply voltage increases. So the combination of the reservoir action of the large condensers with the balancing effect of the choke coils finally results in a smooth flow of direct current suitable for use instead of B batteries in your radio set.

THE remaining function of the B battery eliminator is to by-pass part of the current in such a way that a lower voltage is available for use on the detector tube. All good eliminators are so built that the detector voltage can be varied within adequate limits. Some of them also provide for a variable amplifier voltage.

There is nothing particularly new about the filter end of the circuit in a B battery eliminator.

The marvelous new developments that have made B battery eliminators practical for the radio fan are all in the rectifying

It's Simple to Install

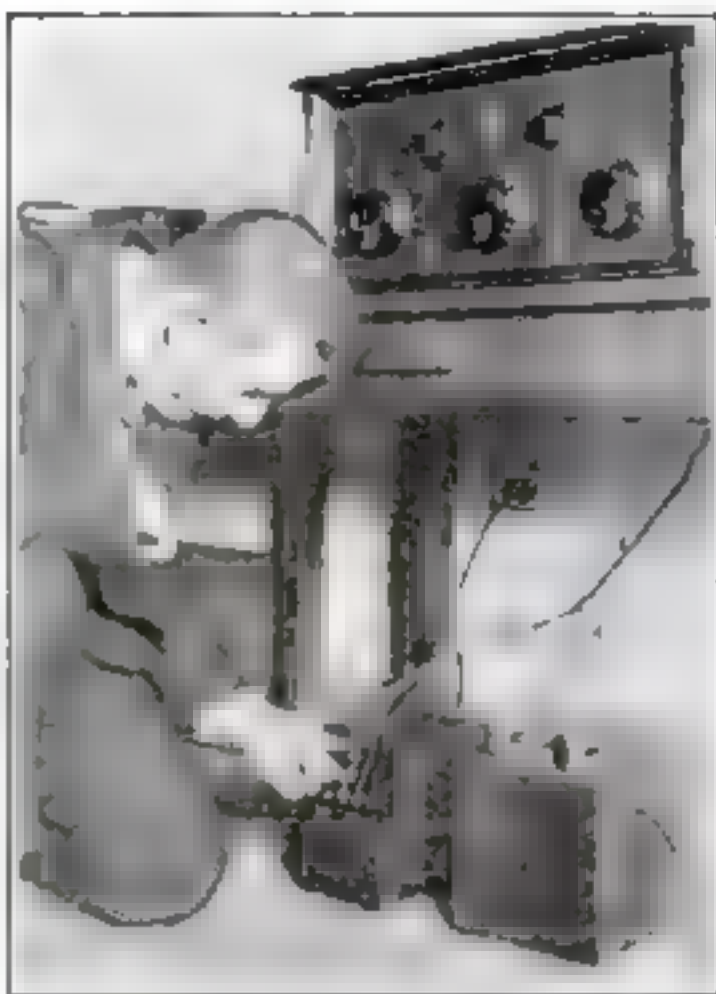


Fig. 3—Simple installation of a B battery eliminator. Simply connect wires between the binding posts of the radio receiver and those of the eliminator, and plug the eliminator into wall socket. At right is seen the A battery. A cable holds all leads for battery and eliminator.



Fig. 4—Three different sources of plate circuit supply are shown here. Left to right: Standard heavy duty, 41 volt dry cell B battery, popular type of storage B battery consisting of 24 cells, and B battery eliminator.

end of the circuit. Today we have rectifying tubes capable of rectifying sufficient current to operate the largest of radio receivers and these tubes have an extremely long life.

Fig. 1 shows a number of modern rectifying tubes, which can be divided into two general classes. One general type of which the tube at the extreme right is a popular example, operates by means of a heated filament. At the left end of the picture is an example of the class of tubes which operate without any filament at all. These utilize the ionization properties of a special gas to obtain the rectifying action. Both kinds give equally good results in circuits designed to take care of their particular characteristics. The filament types give up to 1,500 hours of service, or more hours than the most ardent radio fan is likely to run his set during a year.

THE average life of the filamentless type of tube is not definitely known. On test, such tubes have run more than 10,000 hours under full load with no apparent falling off in output. Others have given out in less than that time for reasons ordinarily traceable to some flaw.

The eliminators using electrolytic cells to rectify the current give as perfect service as the tube types if they use the new tantalum-acid combination in the cells. The elements of the cells last indefinitely and the only attention they require is the addition of a small amount of distilled water at very long intervals.

It is possible for the experimentally inclined radio fan to construct a good B battery eliminator using one of the remarkable new rectifying tubes, but the individual parts such as transformers, choke coils and condensers necessary to make up a satisfactory eliminator will cost you as much as a complete factory-built instrument. This means that home construction along these lines will be restricted to enthusiasts who prefer to build their own simply for the pleasure of the work involved.

IN choosing a B battery eliminator all you need to know is the current consumption and the voltage requirements of your radio set, and then be sure to pick out an eliminator capable of supplying the amount of current you need at the voltage necessary for proper operation. And if you know nothing about these features, the dealer from whom you bought your receiver or the manufacturer will be glad to inform you.

Of course there are poor B battery eliminators on the market just as there are poor radio receivers. That it will pay you to obtain the list of apparatus approved by the Popular Science Institute of Standards. This list includes the names of the various B battery eliminators that have been tested and approved. The Institute tests include operation of the eliminator on a number of typical radio receivers, as well as scientific tests to make sure the rectifying end of the eliminator will give a sufficiently long life.

THE installation of the average B battery eliminator is extremely simple. Fig. 3 shows a typical arrangement. Here the radio receiver is fitted with a battery cable that includes all the leads for both the A and B batteries. All that is necessary is to connect wires between the binding posts of the radio receiver and those on the eliminator. Now turn on the current from your A battery so that the tubes are lighted properly and then turn on the B eliminator by plugging in the wall socket and turning the switch if one is built into the eliminator. Now tune your set as usual. As soon as you have a station tuned adjust the detector voltage knob on the B eliminator until the signals are as loud and clear as possible. If the B eliminator also includes a method of adjusting the amplifier voltage, try changing this and leave the adjustment where the voltage is as low as possible consistent with full volume and tone.

When you stop using the set it is always a wise precaution to disconnect the eliminator before you shut off the tubes.

Novel Auto Tools and Fittings



Condenser Saves Alcohol

When steam is used for heating a building, the waste steam is often lost. This device, however, recovers the alcohol from the waste steam and returns it to the boiler. It is a simple device and can be made at home.



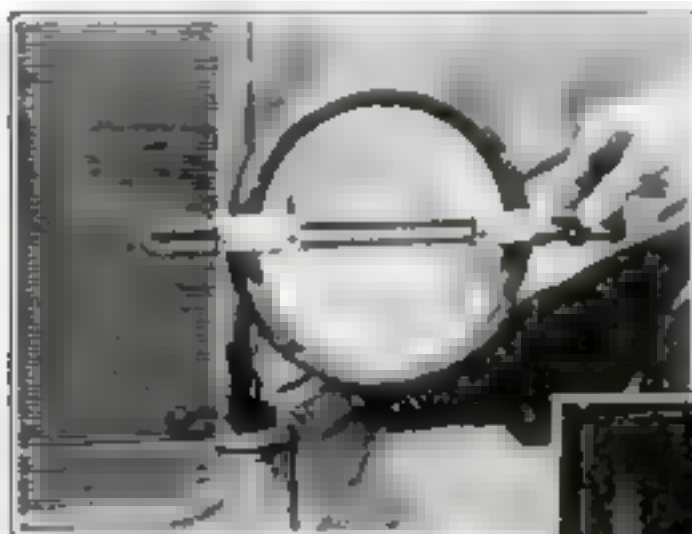
Ingenious Lamp Keeps Motor Warm

Although a motor is a very hot object, it is often found that the motor is too hot to touch. This device, however, keeps the motor warm by using a lamp. The lamp is placed in a box which is connected to the motor. The lamp keeps the motor warm and the motor keeps the lamp warm.



Wrench Holds by Cam Action

This remarkable new wrench is a simple device which holds an object by cam action. It is a simple device and can be made at home.



Handy Lamp-Door Remover

It is a very common thing to find a lamp door which is too tight to remove. This device, however, is a simple device which removes the lamp door. It is a simple device and can be made at home.



Ventilation Without Drafts

This device is found at the top of the side window. It is a simple device which provides ventilation without drafts. It is a simple device and can be made at home.



Socket Wrench Works in Any Position

Many of the nuts and bolts on automobiles are difficult and sometimes impossible to get at with ordinary wrenches. The bolt shown in the picture is a typical example. The new wrench makes getting at this particular bearing a simple job. It is also useful in cylinder head bolts, water circulation outlets, main bearings and such like.



Simple Tool Hooks Chains Quickly

Chains should be put away as soon as they are well used. This device is a simple device which hooks chains quickly. It is a simple device and can be made at home.



Thief Alarm Blows the Horn

This novel device can be installed in any automobile. It is a simple device which blows the horn when a thief is near. It is a simple device and can be made at home.

When Your Ignition Goes Bad

Gus Explains Why Spark Plugs Foul, and Why It Pays to Carry a Spare Condenser in Your Car By MARTIN BUNN

"**H**ERE is the most remarkable spark plug in the world!" asserted the salesman, as he swung his sample case up on the corner of Joe Clark's desk and opened the cover with a flourish. "Can't foul—gives the hottest kind of a spark—never breaks down—lasts forever—and you can sell it at a good profit." He shoved a couple of shiny plugs into Joe's hand.

"They look good," observed Joe, as he examined them. "Are they guaranteed not to foul?"

"Absolutely!" stated the salesman with much emphasis. "They're positively self-cleaning. See the peculiar shape of the recess back of the points? That shoots the exploding gas across the points and sweeps away any and all carbon."

Originally, Joe consulted with Gus Wilson, his partner in the Model Garage, about any additions to their mechanical stock, but as Gus was out and so was the stock of spark plugs, he decided to take a chance.

"All right," he said after his inspection was completed. "I'll take two dozen."

A HALF hour later, Gus drove into the garage with the car he had gone out to test. The engine was running badly, and blue smoke puffed out of the exhaust in great clouds.

"Hey, Joe! Bring out a handful of spark plugs!" he sang out, as he snapped off the ignition, and the engine died with a final spurt of smoke that rolled slowly across the floor in the form of a huge rug.

"Here you are," said Joe, as he popped out of his little office with some of the new spark plugs in his hand. "These will cure the trouble. I just bought 'em, and the salesman guaranteed them not to foul."

"Guaranteed 'em, did he?" Gus growled. "Well, here's where you have a chance to collect. I'll bet this motor is a regular oil gusher."

As soon as Gus had the new plugs screwed up tight, he started the motor and it proceeded to run perfectly without a skip.

"They're the real thing all right, aren't they?" exclaimed Joe, with a satisfied smile.



The salesman told Joe that his "self-cleaning" spark plugs were guaranteed not to foul, an extravagant claim which Gus soon proved to be "bunk" when he placed them in an engine in which the cylinder rings were passing oil and found they fouled like others.

"Humph!" Gus grunted as though he had not heard. "That proves it's not valves sticking. It was running so rotten, I thought maybe the valves were on the blink. The trouble is the piston rings are passing oil, all right. Just wait a minute and watch what happens to your wonderful guaranteed plugs."

The partners stood there watching, as the motor continued to purr smoothly. Even the smoking became less and Joe's satisfied grin broadened. Then suddenly the motor skipped an explosion. The skip became more frequent and at last two cylinders cut out completely, so Gus snapped off the ignition.

"Now try to get your money back from that salesman!" said Gus, as he

the seat that gets on the points is not what puts the plug on the bum. It's the coating of carbon that forms on the insulator around the center point.

Joe's face registered extreme disgust, as he retreated to his office without saying a word.

GUS started to work on the car again, but he had only succeeded in arranging the tool kit to his satisfaction when the roar of a motor sounded outside the door, followed by a vigorous thumping that rattled that sturdy piece of woodwork on its hinges.

Gus flung the door open and found old man Morrison with his foot swung back, just ready to deliver another hearty kick. Morrison, who was reputed to have a purse as long as his temper was obviously short, dropped his foot to the ground and turned to shut off the ignition of his five-thousand-dollar gas buggy.

"The gosh-banged, dad-blamed, confounded piece of junk!" he snorted apoplectically. "The blankety blank thing stopped every time I let it slow down, and twice I had to get out and crack it to make it go again. Look her over and see what in blazes is the matter."

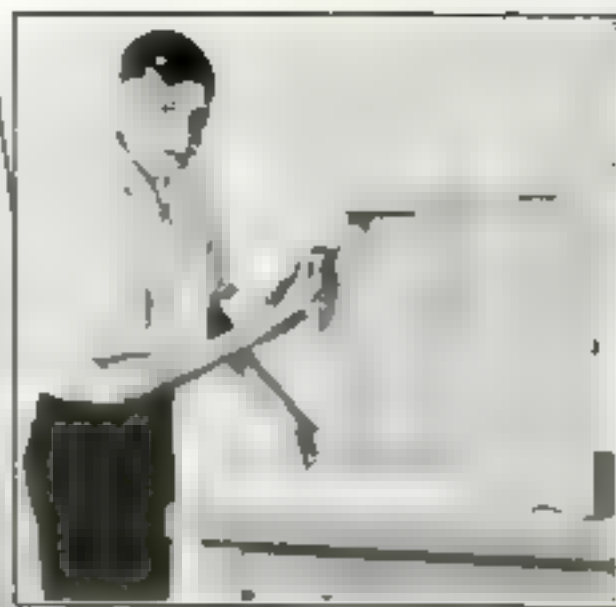
"You say you had to crack it a couple of times, Mr. Morrison?"

"That's what I said," Morrison answered testily. "And once was right in the middle of Main Street—the traffic was all backed up before I got it started."

(Continued on page 150)



Morrison thought condensers were only for radio sets until Gus took him to his test bench and showed him how a broken-down condenser caused his auto engine to stall.



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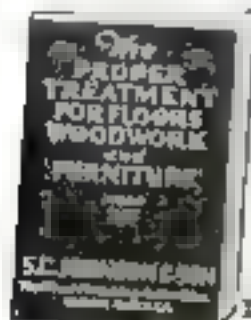
JOHNSON'S WOOD DYE

With Johnson's Wood Dye inexpensive soft woods such as pine, cypress, fir, birch, etc., can be finished so they are as beautiful and artistic as expensive hard woods. Comes in oil and spirit in 17 beautiful shades, among the most popular of which are:

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Ideas You Can Use on Your Car

These Ingenious Kinks Will Save You Time and Trouble

THE AVERAGE motorist who attempts to remove a dent in his fender usually ends up removing the paint as well. In most cases, however, it is possible to remove the dent so that it hardly shows at all and without damaging the paint, provided, of course, that the accident which caused the dent did not injure the paint.

Fig. 1 shows how to do the job. An ordinary cement sack, filled with sand, forms the support for the part to be reshaped. A wooden mallet, with a leather face under which is placed a half-pound of lead brisshot is the tool for hammering the sheet metal.

In addition, you will need a warming pad, made up of four layers of heavy felt, stitched and soaked in oil. You heat this pad on the stove, using precautions to prevent it from taking fire, and then apply it to the dent for a few minutes in order to heat the paint and make it pliable enough so that it will not crack.

IT IS bad enough to get stuck on the road with a flat tire and without a spare, but it is still worse to find that the tire pump has quit the job. Occasionally the threads that hold the barrel of the pump into the base strip out, making the pump useless.

If this happens to you on the road, a simple way to get the pump working again is to dent the lower end of pump barrel as shown in Fig. 2. The dents will force the threads out enough so that they will hold at least until the tire is pumped up.

RUSTY rims are hard on tires. The rust attracts moisture, and the moisture rots the fabric of the tire. Besides, it is sometimes very difficult to remove a tire from a rusty rim—especially if the tire has been in place long enough to allow the roughened surface to adhere tightly to the rubber.

Cleaning a rim by the ordinary method of going over the whole surface with sandpaper or emery cloth, is a long and tedious job. Fig. 3 shows an ingenious way to let the auto motor do all the work. After the tire is removed, the wheel is jacked up and the motor started and placed in gear. Screen wire nailed to a wooden handle or a piece of emery cloth or sandpaper can be held against the revolving rim until all of the rust has been removed.

CHATTERING and jerky operation, especially hard on the gears, shafts and bearings of the Ford. Special oils are being sold that stop this chattering to some extent, but some of these oils have a high soap content, the effect of which is questionable as far as lubrication is concerned.

One Ford owner has solved the problem to his own satisfaction by changing the brake band lining as shown in Fig. 4. Instead of



Fig. 1 Straightening bent fender with a sand bag and mallet faced with lead shot



Fig. 2—How dents repair the stripped threads of a tire pump in emergency



Fig. 3 A quick way to clean a rim with a screen wire brush

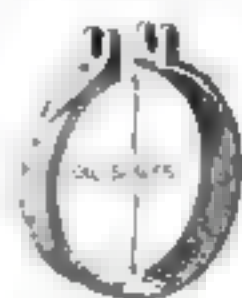


Fig. 4 How one Ford owner prevents chattering by dividing basketband by adding an spacer

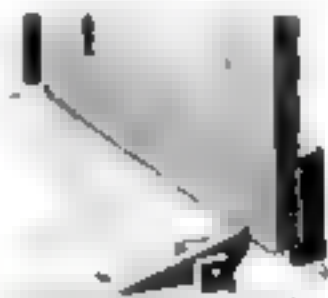


Fig. 5 A simple way to build a garage door stop and catch to make any banging an impossibility



Fig. 6 Ingenious window shade radiator cover (at right) with simple chain adjustment on dash (above)



using one complete piece, he has cut it into two parts arranged with a gap at the bottom. Extra rivet holes were drilled in the brake band so that the lower ends of the band cannot come loose.

Apparently the gap in the lining allows an extra supply of oil to flow into the rubbing surfaces and thus, perhaps, is the reason for the reduction in chattering.

A PRACTICAL and useful arrangement for holding the garage door open so that the wind will not blow it shut just as you are driving out or in is shown in Fig. 5.

To construct the device, only four pieces of wood and one large nail are needed. A stake is driven into the ground at the point where you wish the door to stop when you open it, and then the wedge-shaped piece of wood is cut as shown in the illustration, and a hole is drilled slightly larger than the nail. The wedge is held in place by the nail driven through two small stakes which are driven into the ground.

The wedge and its holders should, of course, be low enough so that when the door is opened it rides over the wedge. The latter drops back into place and holds the door until you desire to release it by lifting on the point with your toe.

A SIMPLE homemade radiator shutter cover which gives perfect regulation of the flow of air through the radiator can be made from an ordinary window shade.

The construction is very simple. A window shade roller is cut down to the proper length and the catch or dog at the spring end is removed. Next a piece of auto top or curtain cloth is cut the right length and width to cover the radiator. One end of this piece is tacked to the shade roller and the other is sewn around a piece of wood which will serve to keep it straight. The roller is attached to the bottom of the radiator by means of ordinary shade roll holders or brackets riveted to the radiator shell, or a simple bent metal bracket may be made and slipped under the side of the shell as has been done in Fig. 6. The spring should be wound up fairly tight before the roller is set in the brackets.

Two flexible wires are attached to the wood strip at the top of the curtain and each wire is led through a piece of small tubing at the top of the radiator. About halfway between the radiator and the dash these wires converge and are connected to a small chain. This in turn runs back to the instrument board and terminates in a ring. The chain passes through a metal plate prepared by drilling a small hole and fitting it into a diamond-shaped opening. This arrangement holds the chain by wedging the links, thus enabling you to adjust the radiator cover.

TEN DOLLARS FOR AN IDEA!

BEGINNING with our next issue, POPULAR SCIENCE MONTHLY will award \$10 in cash in addition to regular space rates each month to the person who submits the most ingenious, novel, and useful idea for the motorist. All other published contributions will be paid for at the usual rates. What little kink have you discovered that makes your motoring more comfortable?

TRIMO pipe wrench



TRIMO

This Wrench asks no Favors in Tight Places

TRIMO PIPE WRENCHES have always been famed as big labor-saving tools — that's why American industries, mechanics, farmers and householders so overwhelmingly favor TRIMO.

The NUT GUARDS (which keep this wrench in perfect adjustment when the tool is being used in close quarters or laid down) is a wonderful time-saving feature. It enables the operator to keep steadily at his task instead of fiddling around every few minutes to adjust the jaws over the object upon which he is working.

The INSERT JAW in the handle (replaceable at small cost — when worn after long service) has given TRIMO economic leadership for nearly 40 years, while its Steel Frame that will not break guarantees durability and personal safety.

This wrench is made in eight steel handle sizes, 6, 8, 10, 14, 18, 24, 36 and 48 inches, and in four wood handle sizes, 6, 8, 10 and 14 inches. The 10 inch wood handle size makes an ideal household wrench. At all hardware, mill, plumbing and oil-well supply stores. Insist on TRIMO — accept no other.

TRIMO Monkey Wrench

This all-steel wrench is 100% drop-forged, has no castings, is simple, has only three parts, is practically indestructible and the strongest by actual test. Seven standard sizes, 6 to 24 inches. Fully guaranteed.



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The Home Workshop

Arthur Wakeling, Editor

Furniture Refinishing Made Easy

An Expert Reveals the Secrets You Need to Know when Restoring Antiques

By RALPH G. WARING

Specialist in Furniture and Auto Finishes

DAN, one of the apprentices, came eagerly into the laboratory to see me the other day.

"Mother has some old, worn pieces of furniture that have been in our family a long time," he began. "I would like very much to fix them up for her and the men told me to come in and ask you about it, Mr. Waring. Will you show me just how to refinish them correctly?"

"To be sure I will, Dan. I said, 'You come around at twelve-thirty each day and I will give you part of my noon hour and I you can go at home. How will that do?'"

"Fine, sir! I certainly will be here. And Jim said he would get the pieces when he went out with the truck."

Sure enough, when 12:30 blew, Dan came in, smiling and over. He had a really fine piece of furniture, a chest of drawers, loved by Jim with a great fervor.

The piece had a frame with rounded corners and a smooth surface.

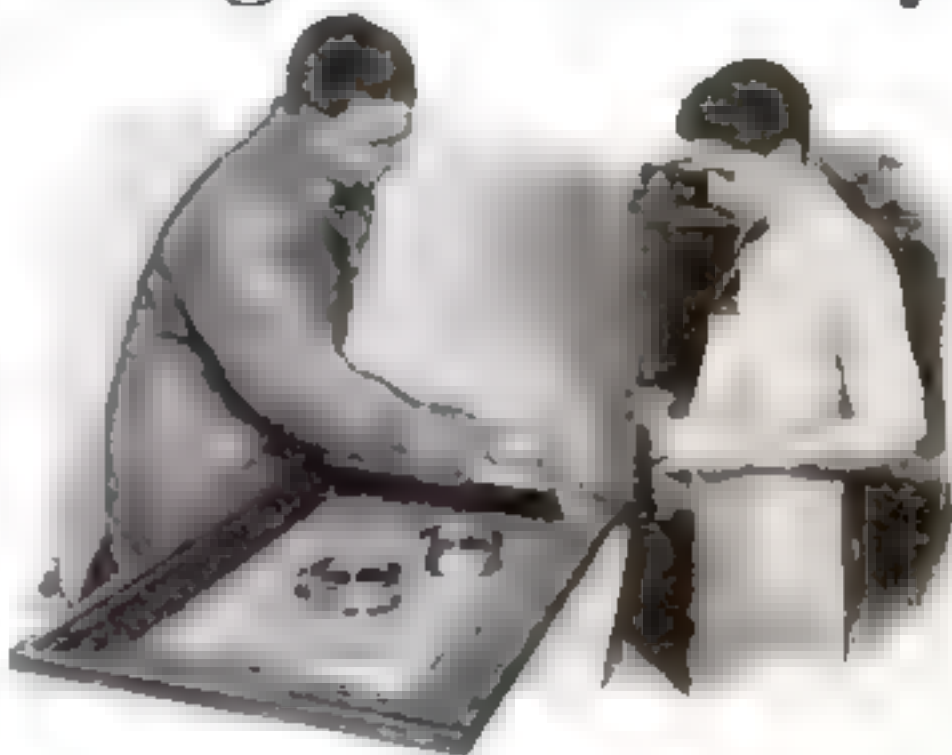
Take out the drawers and get a part of the surface. If the surface is old and if you hear a tiny snapping sound, then the veneer is loose and must be repaired.

Mr. Waring, a consulting chemical engineer, shows Dan how to do staining. This method of holding a brush allows free finger and wrist motion.

Now take out the mirror and store it in that cupboard."

"Don't you take off the old finish first, Mr. Waring?"

"No, Dan, for then the remover would get down beneath the veneer and make a lot of trouble with our glue work. Then, too, if we get any glue on the old varnish it will not matter. Saves time, you see."



"We shall patch up the loose pieces first. The glue must be hot and thick enough so that when you put your thumb and first finger into the pot and take them out the glue will stretch at least $\frac{1}{4}$ in. as you spread finger and thumb slowly apart."

A small piece of tin was used to push the glue under the veneer. The spot then was covered with tin, backed up with a block and well clamped.

"How about curved places?" asked Dan as he indicated another loose place.

"IN THE factory the men use blocks shaped to the same curve, Dan, but we shall take one of these small cloth sacks we use for mailing and fill it nearly full of salt or sand. Now, if the veneer won't lift at that spot, hold a sponge damp with hot water on it or take a piece of wet felt and a hot iron to steam it. That loosens and softens the veneer so that it can be lifted and the glue pushed under. Put a piece of tin over it, lay on the bag, put a block over that, and then clamp so as to force the bag to take the shape of the curve. Let those places set for an hour, then take off the clamps and tin in order that the glue may harden properly overnight."

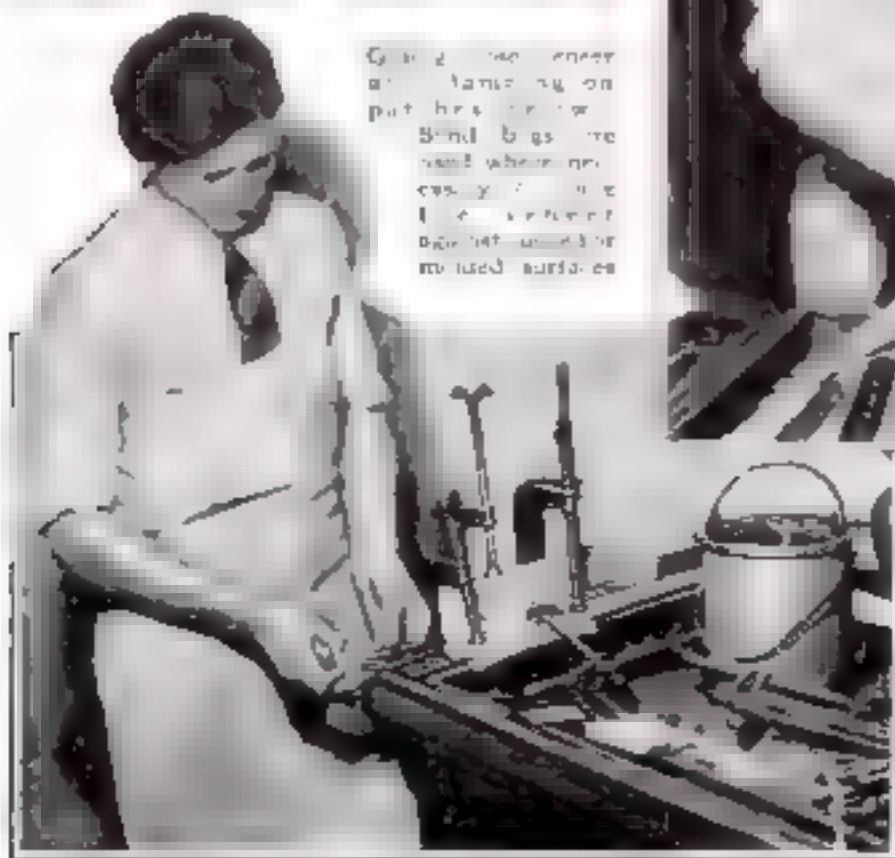
Dan made a good job of cutting and fitting new veneer stock where the original veneer was missing. If it had been necessary to put 5 or 6 in. of new material, the veneer strips would have had to be tacked on a board and a piece of paper glued across. This would hold the pieces together so that they could be clamped more easily into place on the band molding.

(Continued on page 72)



Cutting a veneer patch out. The saw is a rugged blade set in a handle. Fine saw teeth are filed in the thin, beveled cutting edge. The flat face of the knife is held against the try square. Note the veneer strips tacked down so that they can be joined with a small strip of paper glued on. In a furniture factory gummed tape like that made for wrappings is used for joining veneers.

Glue the veneer on the staining on put here in the sand bags are used when necessary to fill the veneer patch and smooth the surface.



Just *What* Tools Do You Need?

*Four Ideal Assortments for the Home Workshop
Are Chosen by a Jury of Expert Craftsmen*



GOOD tools delight the heart of every man. To own them gives keen satisfaction, and to put them to work is for the amateur mechanic a fascinating and profitable pastime.

In these days of high costs, no household can afford to be without a chest or cabinet well filled with tools. They are essential even if they are made use of only in the small repair jobs that constantly require attention in every home.

"What tools do I need?" is, therefore, a question of immediate and vital interest. Too often one sees a well intentioned home owner painfully and laboriously trying to cut 4 by 4-in. rough chestnut posts for a grape arbor with a fine 18-in. crosscut saw, the teeth of which have little or no set. The saw may be a costly and splendid tool, designed for the finest cabinet work, but it sticks, binds, and hickles when driven by man strength through green timbers.

Conversely, another amateur mechanic, in undertaking the construction of a bookcase or kitchen cabinet, will attempt to cut up the stock with a large, coarse saw, the teeth of which have been set widely so as to hew their way through rough and heavy boards.

It is possible that an expert carpenter could cut the heavy posts with a fine saw without seriously damaging it or wearing out his strength, and that he could make reasonably straight and square cuts through expensive finishing lumber with a coarse, heavy saw intended for rough work, but the amateur mechanic cannot do so. It is futile for him to try. He must not only have good tools, but also the right tools for the work in hand.

As the question of what

tools to buy comes repeatedly from readers to the Home Workshop Editor in all sorts of guises and variations, it was decided to organize a committee or jury of six specialists in this field for the purpose of working out ideal tool assortments for the home workshop.

Whether you wish to purchase a new outfit or to add to the tools you already own, you will find that the following lists will be most helpful. They represent the consensus of

opinion of men who have made notable contributions to the Home Workshop Department in the past, and all of whom are acknowledged authorities:

William J. Edmonds, Jr., a craftsman and contributor of many woodworking articles to *POPULAR SCIENCE MONTHLY*.

Emanuel E. Erickson, Head of the Department of Vocational Education and Community Mechanics, State Teachers College, Santa Barbara, Calif., noted manual training authority and contributor of the series on woodworking methods that has been running for many months in the Home Workshop Department.

Edwin M. Love, craftsman and specialist in woodworking methods, author of the attic room series now being pub-

lished in this magazine, and a very well known writer on furniture making.

Albert S. Peacock, of the Department of Mechanical Engineering, New York University, who wrote the article, "Your Tools and Their Care," in the September, 1924, issue.

F. E. Tustison, Head of the Department of Science and Home Mechanics of Stout Institute, Menomonie, Wis., author of several standard sets of job sheets in home mechanics and woodworking that are used very widely in schools throughout the country, and contributor to the Home Workshop.

William T. Weld, Shipwork Instructor, Central High School, Peoria, Ill., and contributor to this magazine, as well as to various manual training magazines.

The first question put before this jury was:

What is the best small assortment of tools for doing repair jobs about the house and garden and for ampie woodworking—a typical handyman's set that no household should be without? Four or more votes were cast for each of the following tools:

Household Tool Assortment

Nail or claw hammer, bell face preferred
Crosstut or hand saw 24 in. or 26 in.
Carpenter's brace, metal fitted, box edge, 1 in.
Bit brace & 3-in. sweep ratchet preferred
Auger bits, 3/4 and 1 in.
8 stock drills for metal, 1/8 and 1/4 in. Useful also for wood
Screwdrivers, 4 in. and 8 in.; 10 in.
Combination pliers, 6 or 8 in.
Files—saw file, 6 or 7 in., flat or mill bastard, 8, 10, or 12 in., auger bit file
Jack plane
Try square, 6 or 8 in.
Steel framing square
Zigzag folding rule, 4 ft.
Measuring tape, wooden
Pipe wrench, 10 in.
Monkey wrench, 10 in.
Mallet, wooden
Working bar, small
Oiletone artificial combination
Nail set, 1/2 in.
Oil can
Half hatchet
Cold chisel, 1/4 in.
Putty knife

The Jury of Tool Experts



William T. Weld



Emanuel E. Erickson



F. E. Tustison



Albert S. Peacock



Edwin M. Love



William J. Edmonds, Jr.

Several of the jurymen wished additional tools incorporated in this assortment. Three of them thought a rip saw necessary, but disagreed as to the size, one voting for a 22-in. rip saw, another for a 24-in., and a third for a 26-in. The remaining jurymen, however, felt that whatever ripping had to be done in connection with the average small repair job could be accomplished satisfactorily with a 24- or 26-in. crosscut saw, provided it was sharpened for general work and was not finer than 8 points to the inch.

Three of the jurymen desired to include a 1/4-in. chisel, and two of them thought both 1/4- and 3/8-in. chisels also were necessary.

(Continued on page 82)

MILLERS FALLS TOOLS

AUTOMATIC

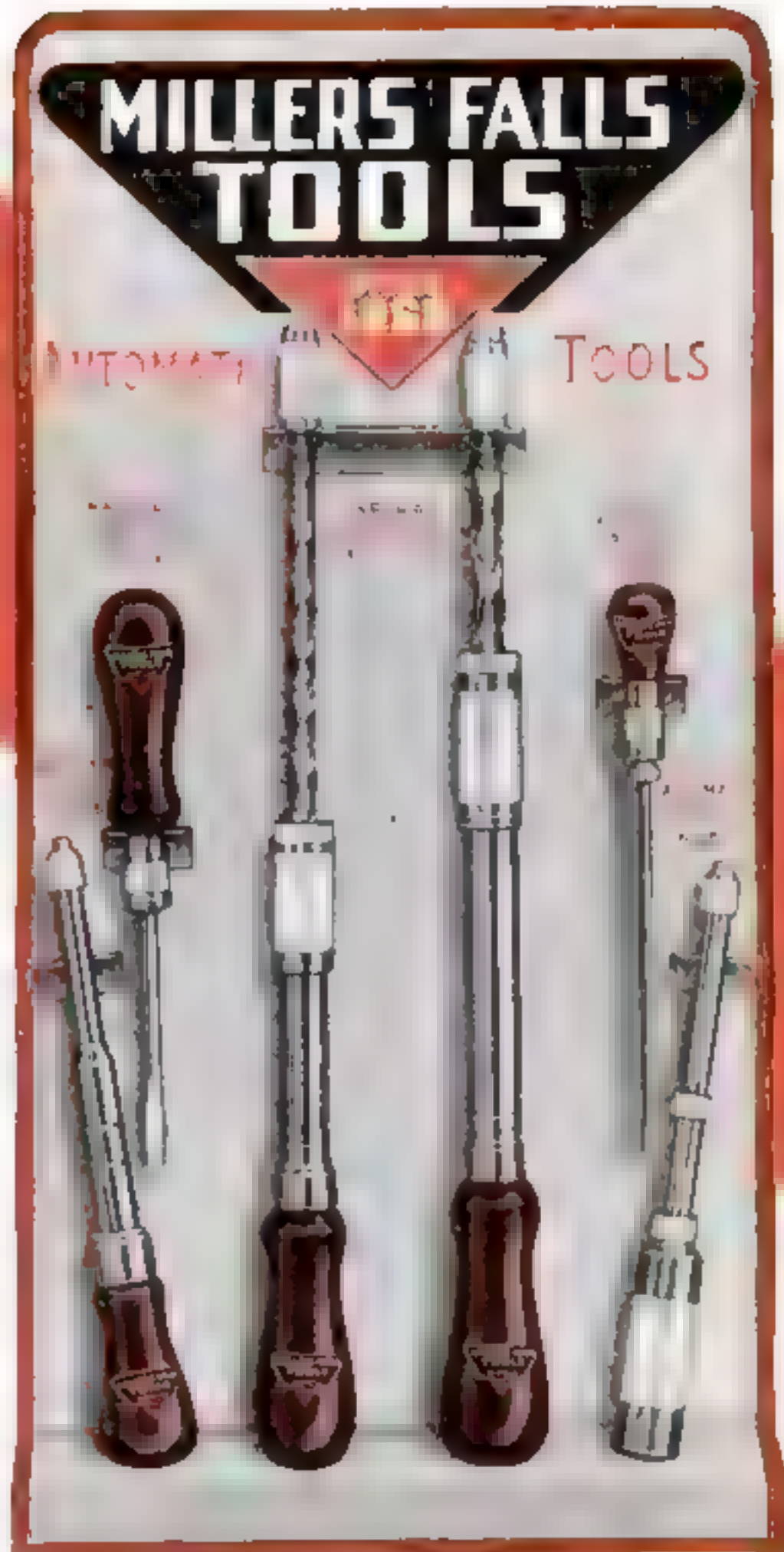
TOOLS



**Look
them over
—try them**

The display shows
six of our popular
Automatic Tools

*Read more about them
at the bottom of this page*



THERE is real satisfaction in using good tools. These Millers Falls Automatic Tools, for instance—they'll work with you for years and years and never let you down.

Do you want to know them—or know them better? Then look for this display in your hardware store. It makes it easy for you to inspect them—"heft" them. They will give you a good idea of the finish, design and working qualities that have built Millers Falls reputation for the kind of tools good workmen prefer.

28 Warren St. **MILLERS FALLS COMPANY** 9 So. Clinton St.
NEW YORK MILLERS FALLS, MASS. CHICAGO

Automatic Drill No. 445

A NEW and popular member of our family of five automatic drills. Reliable handy low in price.

Ratchet Screw Driver No. 63

COMPACT strong quick convenient and easy to use. Every tool user will find one of these helpful.

Spiral Ratchet Screw Driver No. 61

EVERYTHING in one screw driver—about the finest tool you can own. Three actions—spiral, ratchet, rapid.

Spiral Ratchet Screw Driver No. 62

THIS is No. 61's big brother—longer heavier sturdier. Three Modes furnished with each spiral screw driver.

Radio Ratchet Screw Driver No. 55

FOR radio and other jobs work with small screws. Mounted on an easily carrying screw case.

Automatic Drill No. 81

OUR "mini-drill" takes hard work as well as soft. Drill points easily accessible.

How to Make Your Own Screens

A Woodworker Shows You an Easy Method of Putting Together the Frames—The Trick of Stretching Wire Cloth Tightly

By EMANUEL E. ERICSON, *Noted Manual Training Authority*



Fig. 1. If you set up your own screen work from wood, the frame must be planed on the edges.



Fig. 2. Making an end cut in two corners, using numbers as guide.

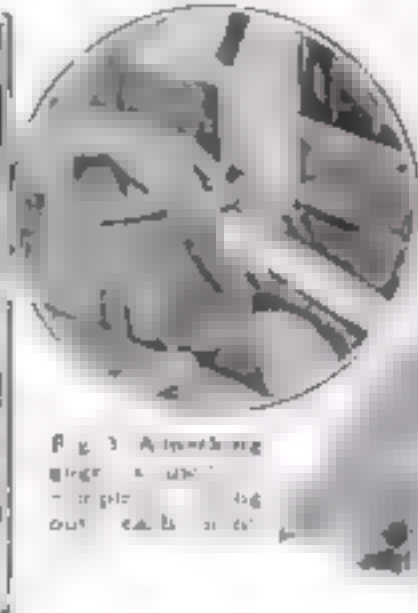


Fig. 3. Stretching wire cloth, using a mallet to pull out each section.



Fig. 4. Using a hand saw to cut the frame in a piece of wood, getting the frame square. The cut can be finished with a plane later, if necessary.

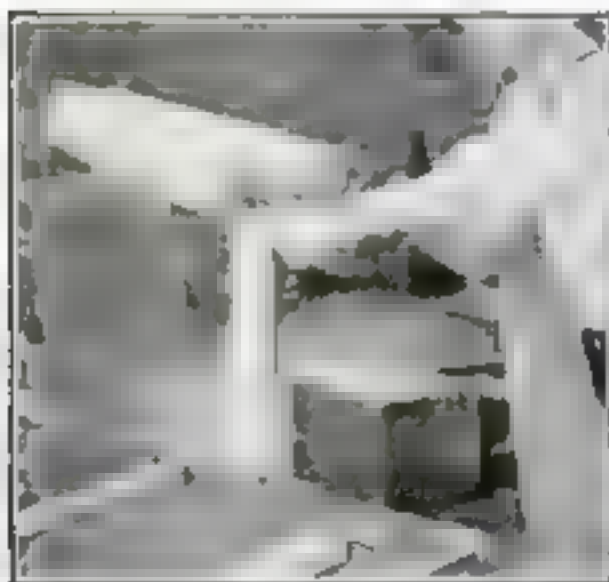


Fig. 5 (above). Making the second cut with a rip saw. Fig. 5 (center). Nail the joints well with eightpenny finishing nails.



Fig. 6. After being assembled, the frame is smoothed with a plane and then thoroughly sandpapered.

SCREEN windows and doors for the home can be made easily by any one who possesses a few woodworking tools and a workshop.

The most convenient way to make the frame for window screens is to use the lumber yard or mill directly cut to the dimensions. We will use a standard size of Oregon pine for the frame. The strips should not be tighter than 1 by 2 in. (these actually measure $1\frac{1}{2}$ by $1\frac{1}{2}$ in.) for the side and top pieces, and $2\frac{1}{2}$ -in. material for the bottom. The middle bar may be narrower, but not less than 1 in. If the outside casings of the windows are $1\frac{1}{2}$ in. thick, lumber of the same thickness ought to be



Fig. 7 (above). To make one end of the frame, use a strip of wood as the base. Fig. 7 (below). The screen is stretched on a strip of wood.



used for constructing the screen frames. If this material cannot be obtained readily, it is a simple matter to rip the pieces from planed boards of any width. When cutting the pieces roughly to

width at the mill, very little planing needs to be done.

One of the most important parts of the job is the laying out. It is best for the

(Continued on page 75)

TURN TO PAGE 75 FOR THE CONTINUATION OF THE HOME WORKSHOP DEPARTMENT



In order to work successfully at a mechanical trade or to take pleasure in making things at home you need good tools, tools that will stand up and do the work required of them.

The Peck, Stow & Wilcox Co. has been making good tools for more than 100 years. These tools, formerly branded P. S. & W. Co., now branded PEXTO, are of the highest quality and are **FULLY GUARANTEED** as to workmanship and materials.

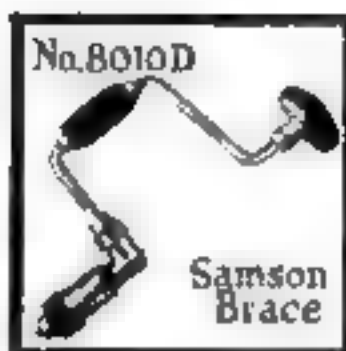
The line consists of Bit Braces, Auger Bits, Squares, Chisels, Hammers, Hatchets, Pliers, Monkey and Pipe Wrenches, Angle Wrenches, Screw Drivers, Snips, Compasses, Pruning Shears, Dividers, Calipers, Pincers, Soldering Coppers, and many other small tools.

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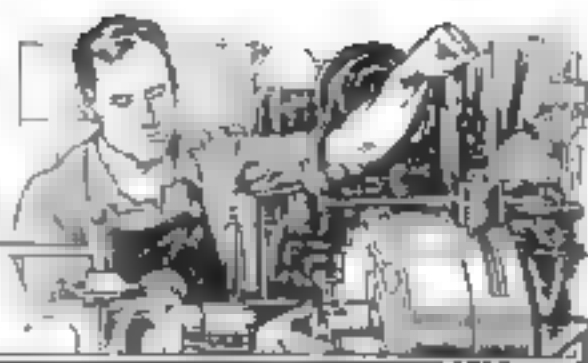
THE PECK, STOW & WILCOX CO.
SOUTHINGTON, CONN., U. S. A.

*Worth
While
Tools*



Better Shop Methods

How Expert Mechanics Save Time and Labor



Old Bill Talks on Cutting Fluids

Are They Really Lubricants or Just Cooling Agents?—Hints on How to Choose the Most Efficient Cutting Oils and Compounds

WHILE a cold March rain beat drearily against the shop's saw-tooth roof and coursed in silvery streams down the expansive windows, Old Bill's men leisurely consumed their lunches and chatted about the prospects of getting their baseball team out for a little practice when the yard, which was now a morass from thaw and downpours, had dried sufficiently to allow them to spend their noon hours outside. But baseball seemed still too remote for much enthusiasm and their conversation drifted into shop talk.

"Let me tell you this," Harvey Lewis was saying. "Not one of you, I'll bet, can explain the action of cutting oils and compounds. We all know that by using a certain fluid with this or that operation, we'll get certain results. But why?"

"They are just lubricants," some one volunteered.

"Go on!" retorted Lewis. "That's what I thought you would say. In fact, it's what the handbooks and the manufacturers of cutting compounds tell us, but I could never see it. Where does the lubrication come in?"

"Oh, they also tell us that the oil cools the tools and the work, as well as lubricates them," put in Joe Kents.

"Yes it cools—and nothing else," said Harvey. "Then why call it a lubricant?"

Old Bill, nursing his pipe, and with his right thumb hooked in the shoulder strap of his overalls, had come up to the group.

"WELL, Harvey, if you have been studying up this proposition, let us hear why you have come to that conclusion," suggested Old Bill, who was always anxious to draw out his men. "One would think that the people who handle and sell these products ought to know more about them than we do, and you said yourself that most of them refer to oils and compounds as cutting lubricants. I have always thought they both cooled and lubricated."

"A cutting oil or compound," Harvey replied, "is primarily intended as a cooling medium to carry away the heat generated by the friction of the tools in cutting the work."

BY H. L. WHEELER

Machine-Shop Foreman

"What about hand taps and threading dies?" inquired Kents. "They are seldom worked fast enough to cause any heat. How do you account for the action of oil in their case?" If oil has only a cooling function, we might as well not use it for tapping and threading.

The boys thought Harvey was cornered, but he had another argument left.

"But how do you explain the fact," he demanded, "that the poorest lubricating oils make the best cutting oils and that

A blast from the shop's whistle put an end to the discussion, but it had lasted long enough to give the machinists an inkling of how much there still remains to be done before shop practice in regard to the use of cutting oils and compounds can be standardized.

Opinions vary on the merits and demerits of the many different oils and compounds. There is no universal rule in their application. Each shop finds by experiment or custom what is best suited for its particular purposes. Only in a few instances is there any general agreement that one oil or compound is best for a given operation. Hand tapping and threading may be cited as one example; for this class of work pure lard oil is favored.

Before the days of high speed, quantity production, little was thought about the subject at all. The necessity of using one or other cooling medium was not considered vital. In early machine-shop practice most metal working was done dry with slow speeds and feeds.

Gradually water came into use and then followed the various oils—animal, vegetable, and mineral. With the expansion of industry came a demand for cheaper substitutes, which resulted in the use of the many different soaps and

alkali compounds with which we are familiar today. Some of these are patented.

For certain kinds of work pure lard oil has no equal, but, owing to its high cost, it has been found expedient to dilute it with cheaper oils and soap compounds. And through this practice have been developed many valuable formulas.

A COMMERCIAL product known as mineral lard oil is regarded as one of the best substitutes for pure lard oil. The quality of mineral lard oil, however, varies greatly and the name alone seldom conveys any definite idea of the quality.

A common objection found in many oils and compounds is their tendency to create sores, boils, and ulcers on the hands. If a man has a cut, there is danger even of

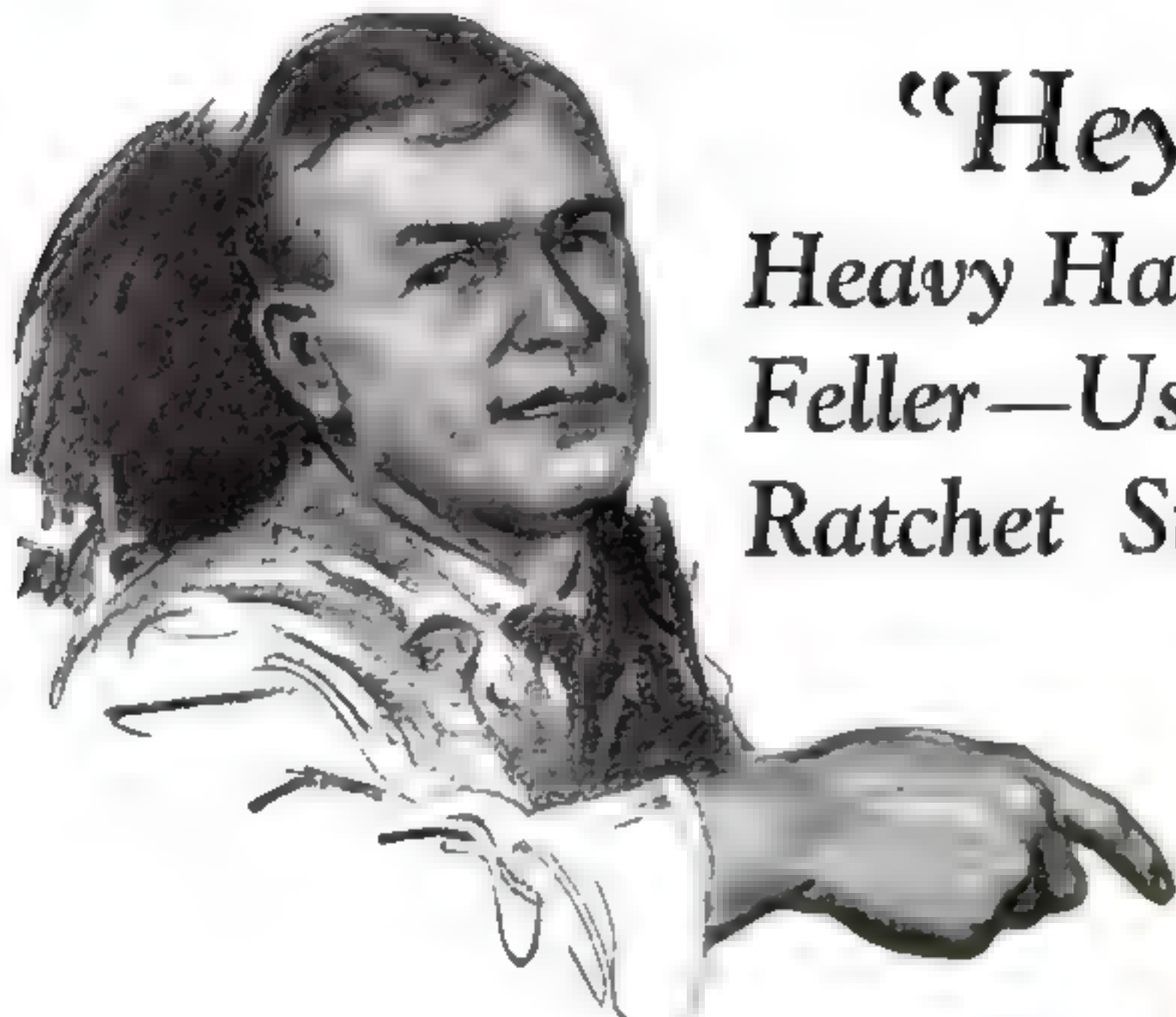
A cut need on page 129.



Joe Kents cited hand taps and dies to prove that our cutting fluids are lubricants rather than coolants.

the best quality of lubricating oils do not give satisfactory results when used as cutting oils? I have tried out pretty nearly every kind of oil and have found this to be true."

"That may be true," admitted Old Bill, "but it is rather a description of what we have found out through experiment than an explanation of the cause. Perhaps we can't go much farther than simply to say that the use of oils and compounds is helpful. Cutting tools generate heat and the oil or compound keeps the tool and the work cool, and that allows us to remove more metal in a given time. The fluid insures a longer tool life, besides making possible increased production. It washes away the chips and allows a better and more accurate finish. In these ways it speeds up the work and reduces the cost of machining."



**"Hey!
Heavy Handed
Feller—Use the
Ratchet Stop!"**

"You'll do better, more accurate work and y'won't be springing that mike I just lent you!"

A Ratchet Stop does help the man whose "feel" is not supersensitive and it helps any man to do quicker, accurate work because it relieves him of the necessity of always guarding against springing his mike by jamming the spindle against the work.

That's one reason why a lot of men like the Starrett

No. 230—it has a Ratchet Stop. Another, bigger, reason is the cut-away frame. You can get it into lots of places where an ordinary frame can't be inserted.

Ask your dealer to show you this tool. Write us for descriptive matter and Catalog No. 23 "W."



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World's Greatest Toolmakers
Manufacturers of Hackaws Unexcelled
Steel Tapes—Standard for Accuracy
ATHOL, MASS.



Use Starrett Tools



While hand holds driver steady, you start screw with thumb and index finger.

Starting small wobbly screws is easy with a "YANKEE" No. 15 Ratchet Screw-driver

Not only easy, but fast. With thumb and forefinger you revolve knurled washer on blade and quickly start the pesky little screw.

After starting with thumb-turn, you send screw home by ratchet movement.

No. 15 (illustrated) comes with 2, 3, 4, 5, 6, and 8 inch blades.

One grip on the handle is all that is needed. Then turn to and fro, and the smooth "Yankee" Ratchet does the rest. Right and left ratchet; and rigid.

No. 15 Comes with 2, 3, 4, 5, 6, 8 and 12 in. blades.
No. 11 Same as No. 15 except that Ratchet Shifter moves across instead of parallel with blade.

Some Other "Yankee" Tools

Plain and Patent Screw-drivers
Ratchets, 11, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

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WOODWORKERS

B. E. M. COOK

of limited experience are timid about attempting wood carving. They think it requires long training and special aptitude. In reality, any one who wishes to do this kind of work need not hesitate a moment. The only skill required is a steady hand, together with patience and an eye for symmetrical design. An illustration of what can be done is the chest shown, which was carved by the writer when he was 16 years old.

My mother had expressed a wish several times for a cedar chest, so I made one of gunwood lined with cedar and started to carve it with nothing but ordinary woodworking chisels and a skew

section and carried toward the edge, only a

small shaving being taken each time.

In carving, the last cut made by the chisel is the finished surface, sandpaper is not used. It is no detriment to have the chisel marks show; in fact, it is considered a desirable characteristic in carved work.

The gunwood exterior was stained a dark brown in this instance and oiled with several coats of a mixture of half turpen-



Front and top of a gunwood chest lined with cedar, which was constructed by Mr. Cook when he was 16 years old. It was his first attempt at carving. He believes that the difficulty of carving is overestimated by most woodworkers.

chisel ground from a $\frac{1}{4}$ -in. file. My father, having seen what I was doing, gave me a set of carving tools and I continued to work at odd times for the greater part of a year. When finished, the chest was entered at a state fair and drew first prize in the advanced class. Our city school supervisor saw it and as a result he encouraged me to continue studying manual training until I finally became a teacher of that subject in the Des Moines, Ia., high schools.

In this instance the design was made up as the work progressed, only the main spaces being blocked out at first. The work was started from the center of each

one and half boiled oil, to be applied hot.

While a set of half a dozen or more carving tools is desirable, the work can be done with a skew chisel about $\frac{1}{4}$ in. wide and a parting tool to start the center of each cut. It is essential that the tools be kept sharp. This is done by honing them on a fine oilstone or slip and stropping them on a piece of emery-covered leather.

If this type of work appeals to you, you will find it becomes constantly more fascinating as you go along, as is indicated by the fact that the writer made three more chests after completing the one illustrated, as well as many other carved articles.

Elaborate Radio Cabinet Costs Less than \$20

ELLIE CRASS, of Paducah, Ky., who built the upright radio cabinet illustrated, was encouraged to undertake this elaborate piece of work by an article that appeared in the Home Workshop Department in February, 1923. He writes:

"To build an ideal radio cabinet is neither difficult nor expensive if the details shown in POPULAR SCIENCE MONTHLY's Blueprint No. 16 or the article that appeared in the February, 1923, issue are followed.

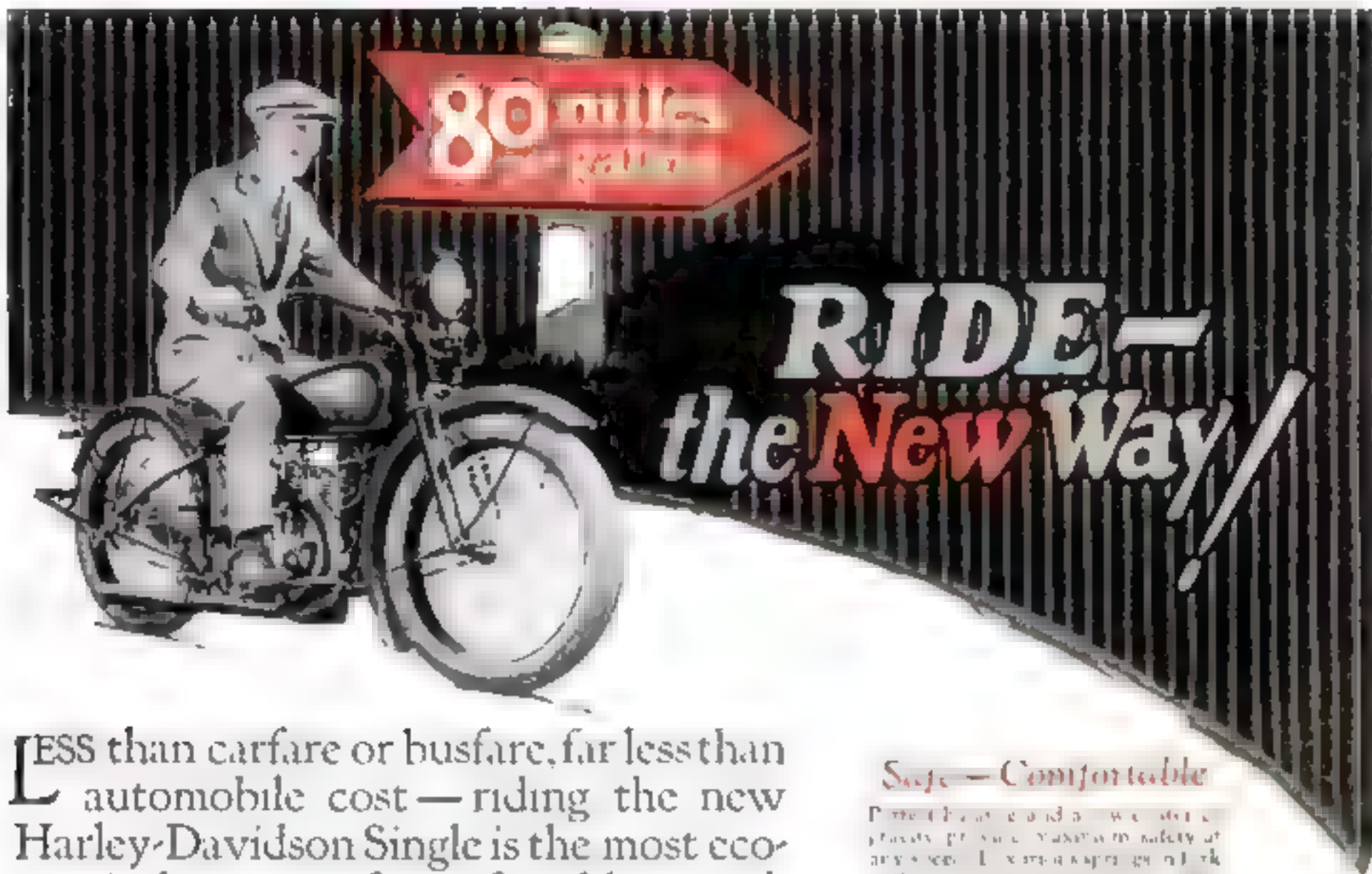
"In building the cabinet



Built by Mr. E. Crass, resident of Paducah, Ky.

shown, I used No. 1 seasoned oak for the framework, at a cost of \$8. The side panels were given to me by a friend. Front doors and scrollwork were made at a lumber mill at a cost of \$5. The cost should not exceed \$15 or \$20, and if cheaper lumber is used, it can be built for less."

There are two radio cabinet blueprints in the Home Workshop series (see page 86). One is a large and elaborate inlaid cabinet (Blueprint No. 16) and the other is a greatly simplified cabinet resembling a Spanish desk (No. 35).



LESS than carfare or busfare, far less than automobile cost—riding the new Harley-Davidson Single is the most economical means of comfortable travel.

Wholly a new type of machine. Travels 80 miles on every gallon of "gas"—ample power and speed for all road and traffic conditions—above all, a safe, sensible, comfortable mount for everyday use by everybody.

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Ask your Harley-Davidson Dealer for a demonstration. Mail coupon for illustrated literature.

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The New
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Single
 [The New-Type Motorcycle]

Safe—Comfortable

Powerful and a well-balanced machine, giving maximum safety at any speed. Luxurious springs, fork and seat post absorb road bumps and rough roads. Low saddle position adds to riding comfort and ease of handling. Balloon tires and broad footboards add the finishing touches to comfortable riding.

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Ride right up to your destination—and park there. Any 2x8 space will house your Single—in a hallway, on the porch, in a garage corner—anywhere. No parking troubles in even the most congested centers.

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The Single is low in price. If you prefer to pay for it out of your income, your dealer has a convenient Pay-As-You-Ride Plan that he'll gladly explain to you.

Notes Rich sales opportunities now in the motorcycle business. Write for proposition.

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() Send free literature describing the "New Single"
 () I'd like to sell the New Single. Particulars, please

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Makes Machines Fill the Order

You devise a machine for a definite job; that's why it does the job.

You give the operator a definite task. That's why he makes good the task.

What must be done is done, when it must be recorded. Whatever the order—in terms of production—it's filled when it has to register on a

Veeder COUNTER

This small Rotary Ratchet Counter No. 6) counts reciprocating movements of the lever, as required for recording



the output of innumerable small machines. When the lever is moved through an angle of 40 to 60 degrees, the counter registers one. The further the

lever is moved, the higher the number registered. A complete revolution of the lever registers ten. This counter can be adapted

to no end of counting purposes, by regulating the throw of the lever. Price \$2.00. *Cut nearly full size.* Small Revolution Counter, also \$2.00.

The Set-Back Rotary Ratchet Counter below is for machines such as presses and metal-stamping machines where a reciprocating movement indicates an operation.



Registers one for each throw of the lever and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, \$1.50 subject to discount. *Cut less than 1/2 size.* Set-back Revolution Counter of similar model, \$3.00, list.

Write us about that counting problem of yours—or see how it's solved in the Veeder booklet; copy free.

The Veeder Mfg. Co.
44 Sargeant St., Hartford, Conn.

A Ship Model of Your Own

How to Make the Masts, Sails, Guns, and Other Accessories—The Concluding Article

By CAPTAIN E. ARMITAGE McCANN

Our Barbary pirate ship now is beginning to take shape. We have cut out and assembled the hull, deck, bulwarks, and board as described in the February issue of POPULAR SCIENCE MONTHLY and are ready to get to work on the masts, sails, flags, and accessories—all the fascinating little details that will give our model real distinction and enduring value.

Do not forget that you will make your work much easier by obtaining Home Workshop blueprints Nos. 44 and 45 (see page 80), as they contain full size drawings of all the important parts.

The masts are made from 3/4-in. dowel sticks, tapered to about half that thickness at the top. The mainmast is 10 in. and the foremast 7 3/4 in. long, measuring from the deck; they project up to the hull about 1/4 in. The foremast should be a bit thinner than the main. Both rake forward a bit, especially the foremast.

Cut a slight groove around them about 3/16 in. from the top to keep the rigging from slipping. The knots at the top, which are called trucks, can be beads or small button molds, or may be whittled from soft wood.

The yards to which the sails are fastened invariably were in two or more pieces lashed to-

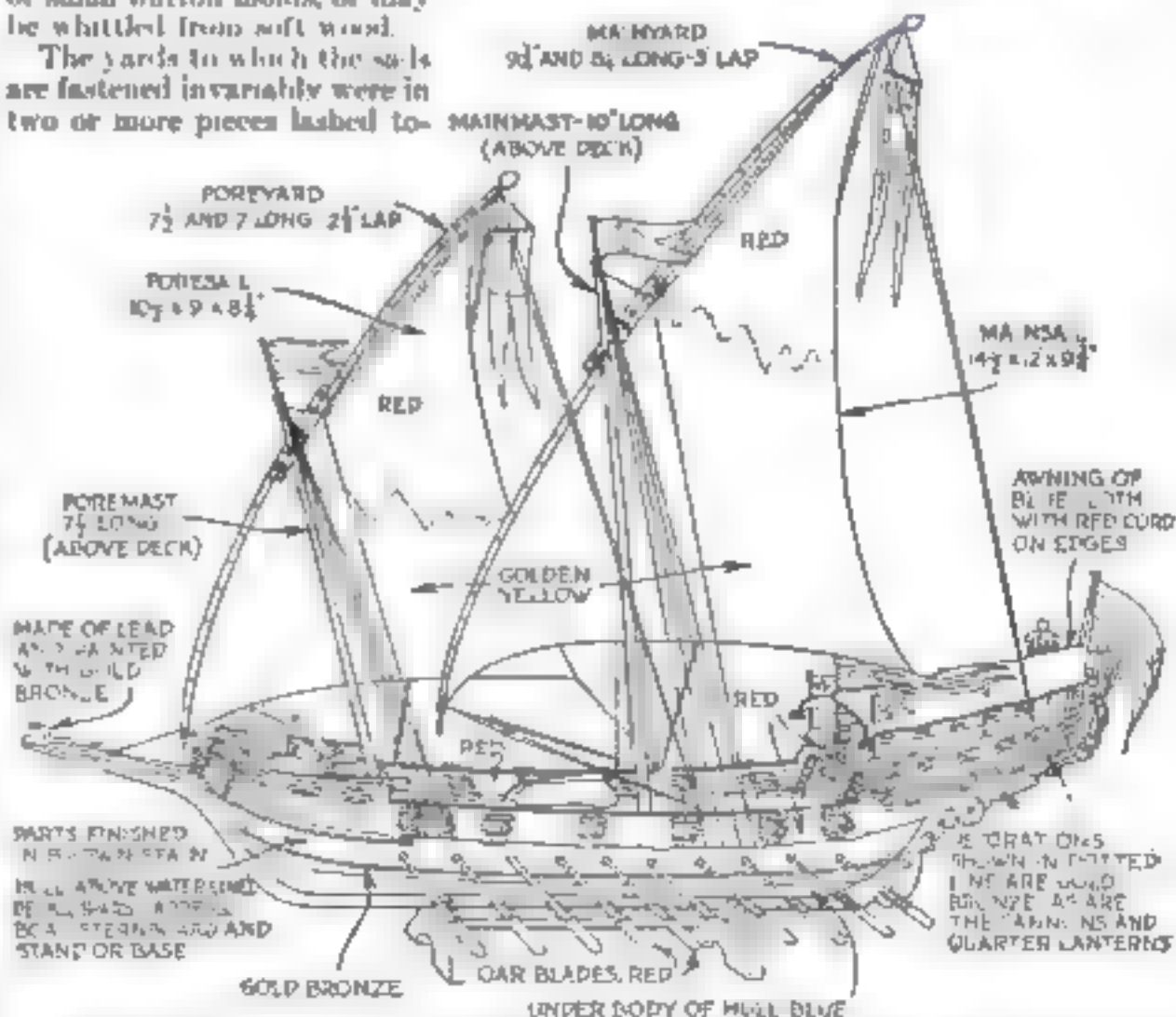


Full size drawings of the parts of this picturesque galley are to be found in Home Workshop blueprints 44 and 45

gether at the thicker ends. On our model they are 3/16 in. dowel sticks. They should be boiled in water for a few minutes and held in position until cool by means of a few nails driven in a board. They have round knobs on the upper ends. Yards and masts look most natural if stained a light walnut or dark oak color.

The sails may be silk or linen. Mine are of an unevenly woven light, dull yellow silk (natural colored pongee) with the peaks "dipped in blood," that is, turkey

(Continued on page 110)



What lifts this rakish pirate felucca above the ordinary ship model is as much its brilliant color as its striking lines. How to paint the ship is indicated here; the colors of the flag are shown on page 112

I wouldn't
ask for
a better
hammer.



©

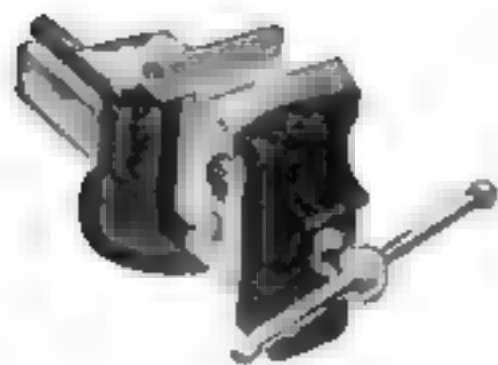
And if I did, I couldn't get it. There's 90 years of practical experience in hammer making and some almighty good material put into every Cheney Hammer.

You'll notice some of the difference as soon as you pick a Cheney up—but you won't get the full meaning of it until you have swung it for a full day.

There's the grip that seems to mold itself to your hand and relieve the strain on the fingers and forearm. There's balance

—and no other hammer hangs quite like a Cheney. There's weight where weight belongs, a head that will neither batter nor chip and claws that grip and grip when you put a strain on the handle.

For real hammer value, ask for Cheney.



For an all-purpose vise
ask your dealer to show you
the PRENTISS.





Homeworker's handiest tool

MEN who are handy with tools, save themselves a lot of money by making useful household articles during their spare evenings. And they get the craftsman's satisfaction of making things skillfully with their own hands—a pleasure which the age of automatic machines and mass production has largely taken away. But LePage's, as the handiest tool in your workshop, helps to give these pleasures back to thousands.

Perhaps you have never thought of the special advantages of using LePage's Liquid Glue. It is always ready for immediate use. No weighing, soaking or heating is required. Its quality is always the same. It "sets" slowly enough so that you have plenty of time to place the joints together exactly as they should go. Slow setting also allows LePage's to penetrate the wood, increasing the strength of the joint. LePage's Liquid Glue is equal in strength to any animal glue. Buy a can for your workshop. It is the easiest, quickest, handiest form of Glue. Insist on LePage's.

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The Home Workshop

How to Make a Wooden Seesaw that Children Cannot Break

By MORRIS A. HALL, M.E.

MANY a man has labored long and diligently to make a toy or plaything for his child or children, only to have it practically destroyed or at least rendered useless within a few days. Children are so rough—consciously or unconsciously, that anything built for them and intended to last must be extraordinarily durable.

The writer constructed for his child a seesaw that has been the source of so much pleasure and amusement that he is glad to have the opportunity of passing along the plans. After six years' use, nearly seven in fact, the time is approaching when the child will have outgrown this toy. It is in such good shape that it can be passed along to another smaller child, who can use it for years to come.

All it will need is an additional coat of varnish or paint.

The seesaw requires only six pieces of wood and can be constructed in a comparatively short time. It consists, roughly speaking, of a 10-in. board mounted on a pair of sole members, which constitute the rockers. These are set out at an angle, or flared, to give additional stability. The ends of the boards are rounded into seat form, while a notch on either side for the legs or knees and a handle at each end give the children using it adequate means of holding on, no matter how violently it is rocked.

The long board must be selected with care. It should be straight grained, perfectly flat, well dried, and free from knots or holes. That which the writer selected, as the drawing shows, was a bit



The seesaw after six years' use

narrower than 10 in. wide and when the edges were planed was but $8\frac{3}{4}$ in. However, any width up to 12 in. and down to 8 in. could be used. This board happened to be 78 in.

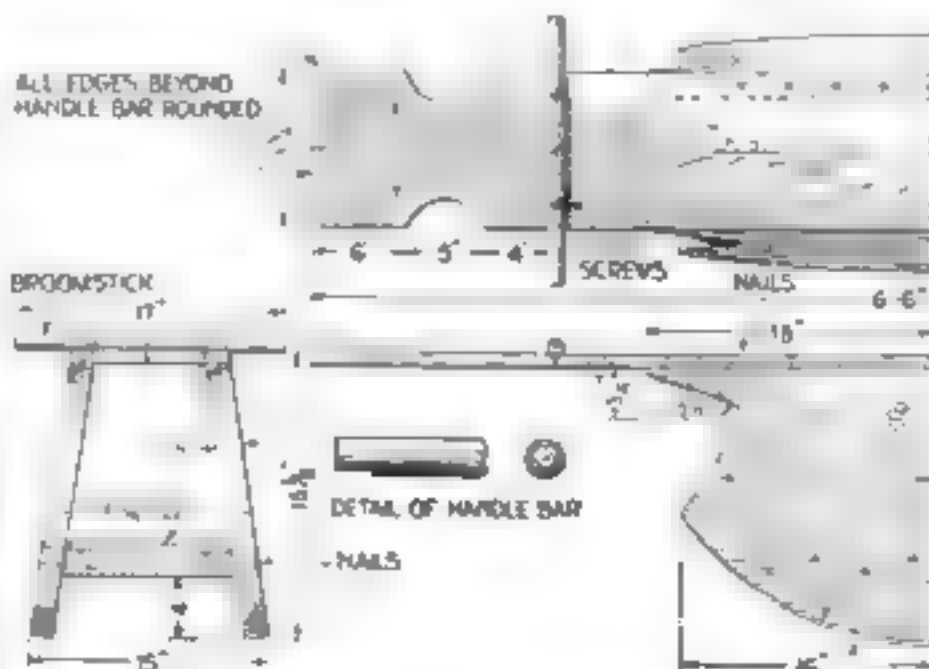
long. Any length from 75 to 80 could be used, and by altering the radius of the rockers to suit, even longer or shorter boards would serve the purpose successfully.

The seesaw will take small children's feet about 10 in. off the ground and that is about as high as most small children care to go, so it represents a fair average and a most useful size.

The sole members or rockers were cut from two heavy boards of 1½-in. lumber planed on both sides. These were 18 by 36 in. originally. They were marked with the aid of a cardboard pattern and cut to the correct shape. The angle at which they are set was obtained by planing off one edge of the upper surface before the top board was attached. These parts were put together very rigidly with large nails, except at the extreme ends, where king, slender screws were used.

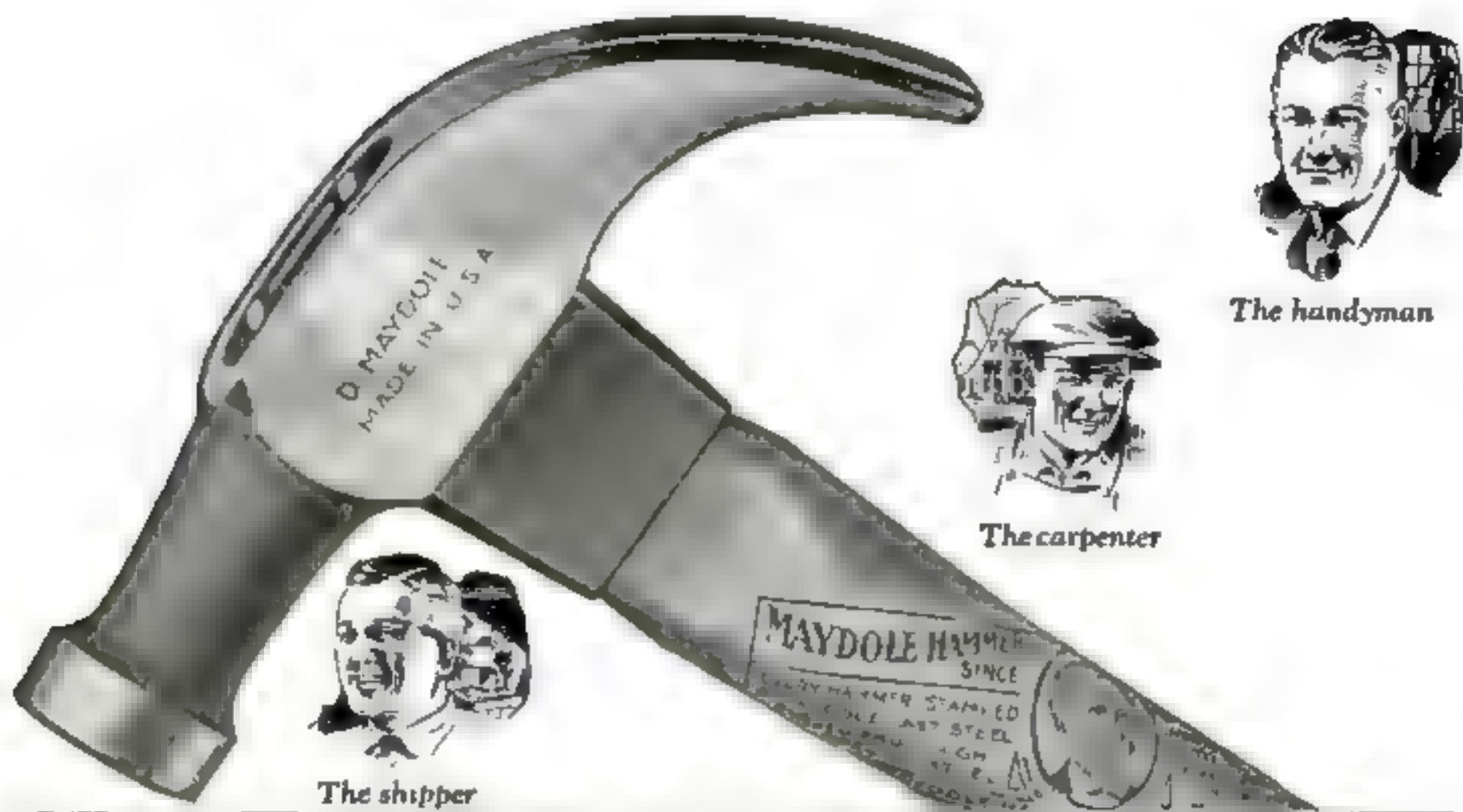
When the rockers had been attached, a block made from a piece of 2 by 10 in. rough lumber was inserted as near the bottom as practical and securely nailed. It was made comparatively short, so that in a casual glance at the completed seesaw, one does not see it.

The ends of the top board were shaped partly by trial, and the handles were located in a similar manner. The latter consist of



Half the top and side views of the seesaw, the end elevation, and a detail of the sturdy broomstick handle-bars

(Continued on page 107)



Maydole Hammers



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The plumber

For men who want the finest hammer

There's one hammer that has been the outstanding favorite of tool users for more than three generations.

THE MAYDOLE HAMMER

Pick up a Maydole. Get the feel of it. Its "hang" is different from and superior to that of ordinary hammers. The head is press-forged of tool steel, tempered separately at each end. The handle is of selected, second growth hickory that has been air-dried for years.

The Maydole Hammer has no "patent" wedges to keep the head tight. It's made tight and it stays tight. There is no stain on the handle to cover up imperfections. It's all hammer—the finest that 83 years of accumulated skill and experience can produce.

Your dealer sells Maydole Nail Hammers, Ball Pein Hammers and all other types. Just ask for the genuine Maydole, if you want hammer satisfaction.

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The auto
mechanic





Make sure your portable is a CORONA

HAVE you ever used a regular office typewriter? If you have, this column will tell you why you should choose Corona as your own personal typewriter. No other portable has so many big-machine features. You'll be at home on it in five minutes.

If you have never used a typewriter, this column will give you a dozen good reasons for making Corona your first and last choice. While you are getting a personal typewriter you may as well have the one that is most like a big office machine—except for weight, bulk, and price.

No other portable typewriter has all these features

THE KEYBOARD has four rows of keys—the same as office typewriters. You don't have to shift for figures. Instead of a six-yard ribbon, Corona's automatically reversing, two-color ribbon is twelve yards long.

The large self-spacing carriage return lever is right up where you want it for quick action. It is the only portable with a real variable line spacer. There is also a convenient stenciling device.

Corona has a shift key on each side. Back spacer and margin release are conveniently located on the keyboard.

You can see what you are writing without moving your head an inch. The visibility is perfect—and at right angles to vision.

The type bar action operates on exactly the same principle as that employed on all the best full size machines—the type comes up to strike the paper.

The full-width carriage takes a No. 10 envelope—just like any office machine.

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The Home Workshop

How to Fit and Hang a Door

Secrets of Applying the Hinges and a Mortise Lock

By EDWIN M. LOVE, Craftsman and Specialist in Woodworking Methods

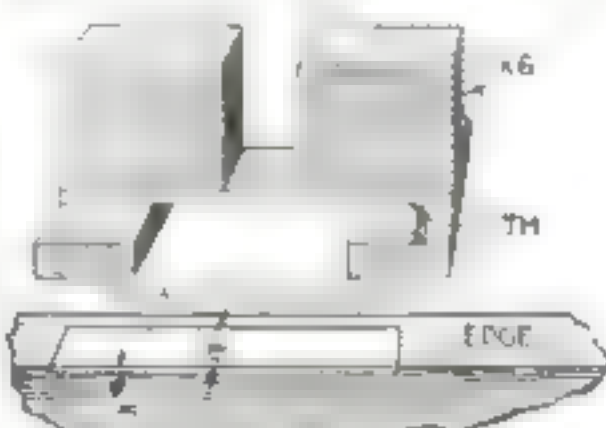
ONCE the methods involved are known, the fitting and hanging of an inside door is not a formidable task for the home mechanic.

If the door to be hung is for a closet or other place where only one side is subject to scrutiny, the best side should be placed outward if possible; but, in general, it is best to sight along one side to note if there is any "swing" in the stiles (long side pieces), and if there is, place the concave side against the stops.

Lay the door on a pair of saw horses and cut off the projecting ends of the stiles. If the latter are of fir, the splintering of the under side hardly can be avoided unless the saw is to run nearly horizontal and the final cutting off is done from the under side. This necessitates more care and extra handling of the door, but the resultant smooth surface is well worth the effort.

Next, build a jack as illustrated in Fig. 1. Nail two short lengths of 2 by 4 in. stock to a piece of lath, keeping them apart a trifle more than the thickness of the door. Under the ends of the thin strip nail blocks for feet.

Mark the lock stile and set the door edgewise with one end of the hinge stile in the jack. Plane the lock stile straight with a jointer or the longest plane you have and bevel the edge slightly toward the stop side. If, however, the lock jamb is crooked, which is the case only too often, make suitable allowances.



LAYOUT FOR HINGE MORTISE

Fig. 1. How to make holder for planing door and how to mark for the hinge mortise



Fig. 4. Reversing the latch bolt after the lock cover is removed



Fig. 2. Marking length of hinge with knife



Fig. 3. "Stepping" the mortise for a door hinge

Now stand the door in the opening, with the lock stile against its stop, and hold the other stile against the jamb edge. Slop a wide chisel underneath for a lever and use a block as a fulcrum. Force the top of the door against the upper jamb and have someone run a pencil down the hinge stile with the jamb as a guide. Lay the door on the horses again and rip off the excess width if it is as much as $\frac{1}{4}$ in. Joint to the line, beveling a little toward the stop side.

Stand the door against the stops, and with scribers or compasses scribe the top rail to the head jamb. Saw and plane to the line, guarding against splintering the stile ends.

THE fitted door should have a clearance of a trifle more than $\frac{1}{8}$ in. all around. If the trim is to be painted in the ordinary way—or a little more for a paint job of more than four coats.

Pry the door up to the top, keeping the necessary clearance by inserting a chip or a hand scraper as a gage. Measure from the floor and the upper jamb the distance to the hinges—usually 11 and 7 in. respectively—and with a knife point pressed between door and jamb mark the positions for the hinges on both of them.

Support the door in the jack. Take the pins out of the hinges and set a gage for $1\frac{1}{2}$ in. Score a right line at $\frac{1}{2}$ the length of each hinge, top and bottom, afterward squaring across for the ends. Take the door half of the hinge, lay it upside down on the stile edge



Fig. 5. Scribing the position of knob spindle and keyhole

(Continued on p. 85)

These Are Bolt Clipper Times

VOL. I

EVERETT MASS., U.S.A.

NO. 1

Saving time with a Bolt Clipper

You certainly start a life job when you undertake to discover all of the innumerable ways in which a bolt clipper can be used around the shop, the factory and the home. Every time you discover a new use you face a new way to preserve the purity of the English language and to increase the value of your working day—because a bolt clipper does its work without the aid of strong language and does it quickly. Bolts, nails, wire, rods and chains are essential contributions to housing, transportation, power and construction; from the hen coop to the concrete road; from the wheelbarrow to the motor bus.



Cutting heavy fence wire

Perhaps you don't know what a bolt clipper is?

It's a tool for cutting off rods, bolts, heavy wire and chains to desired length, anywhere.

When we say bolts we mean big husky ones up to $\frac{3}{4}$ " in size—the kind you find around the automobile mud guards, holding the door plates to the furnace or the sides on the kitchen stove. When we say rods we mean anything from the brass rods which hold up the parlor curtains to those husky iron reinforcements you see in concrete walls.

By wire we mean the clothes line, the radio aerial, guy wires on poles and fences as well as insulated wire on power lines, cables, etc.

As to chains—well of course there are limits to what even a bolt clipper will do but when it comes to the broken links on a tire chain—just reach for the bolt clipper and snip off the broken cross chain.



Cutting fender bolt in hard to get at place

Our message to the readers of Popular Science must be general because this magazine reaches all sorts of tool users—men in all walks of life. When we talk to the automobile mechanic, the road builder the railroad man and others we can deal with specific uses in each one's work—but in this issue of the Bolt Clipper Times we can suggest only a few of the thousands of general uses to which the hundreds of thousands of readers may apply this tool. A bolt clipper belongs in every tool kit, on every work bench, in factory, home and farm shop and is an essential item of equipment for railroad construction men, repair crews on power and telephone lines, on ships, fire department apparatus, in mines, lumber camps—and wherever time saving is essential and man power limited.

To those of you who are unfamiliar with these tools just imagine a device so powerful that it will cut a quarter inch rod as easily as the ordinary nipper cuts the small wire on a radio set. Imagine a two handed tool multiplying man power seventy times. Imagine splitting the nut of a bolt in one operation with moderate effort or snipping off a wagon bolt almost as easily as a pair of scissors cuts a piece of twine.



Housewife cutting brass curtain rod

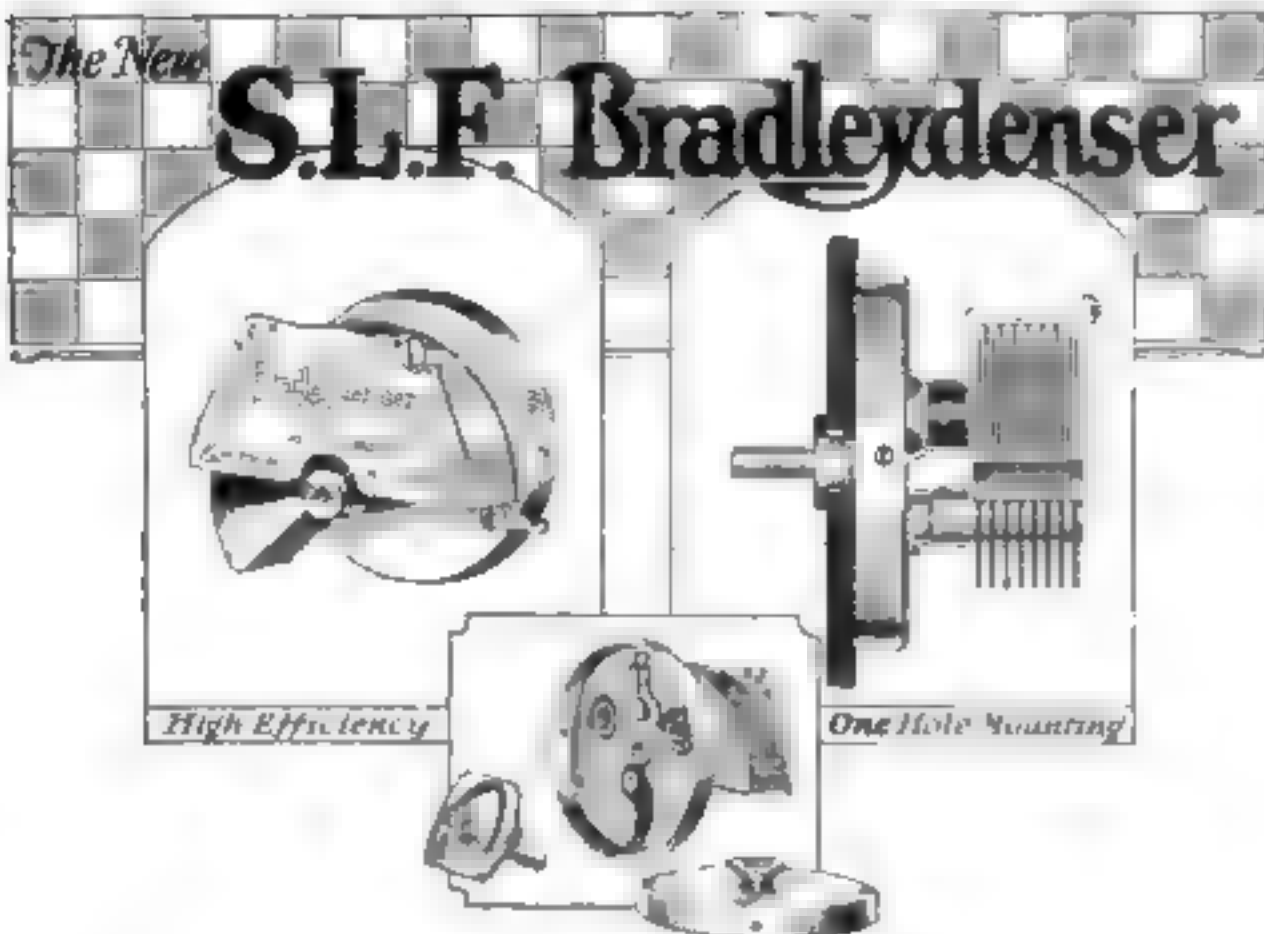


Splitting Nut on Brake Drum

Every hour of every day some man somewhere is laboriously wasting time making work out of a job that should be done with a bolt clipper. If you use tools or if you employ men who use tools we suggest that you write to us or to your tool supply dealer for booklet describing the Porter line of cutting tools. Write to dealer or to H. K. Porter, Inc., Everett, Mass., U. S. A.

ADVENTURES OF PORTER CLIPPER

				
WHEW! I'VE BEEN AT THIS BOLT AN HOUR.	WOW! WHAT A PLACE TO GET AT	IT'S NO USE I QUIT!!	JUST A MINUTE—HERE TAKE THIS NEW BOLT CLIPPER AND SEE HOW	QUICK IT SNIPS IT OFF.



A Compact Straight-Line-Frequency Condenser

THE new S. L. F. Bradleydenser is the outcome of long, careful research in condenser design. It provides straight-line-frequency tuning over the entire circumference of a 360-degree dial. Stations are widely and evenly spaced over twice the dial-spacing of ordinary condensers. This unique control is obtained by using a special cam on the condenser shaft which provides the straight-line-frequency tuning now demanded by all set builders. The efficiency of the condenser is extremely high, due to the unique construction that practically eliminates insulating material in the condenser.

ANOTHER outstanding feature of the new S. L. F. Bradleydenser is the compact design which eliminates entirely the long eccentric rotor plates, ordinarily used with straight-line-frequency condensers. The Bradleydenser can be substituted for any condenser on a set without interfering with other parts on the panel. The one-hole mounting also simplifies installation. The S. L. F. Bradleydenser is the latest Allen-Bradley contribution to better radio. Be sure to bring your set up-to-date by getting a set of S. L. F. Bradleydensers from your nearest dealer.



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Please send us your latest literature on the new S. L. F. Bradleydenser and other items of the Allen-Bradley line.

Name

Address

City

The Home Workshop

Details of Pirate Ship Model Shown in New Blueprint

IF YOU intend to build a duplicate of the colorful pirate ship model that Captain E. Arrington McCann, model ship model expert, designed especially for POPULAR SCIENCE MONTHLY (see page 80), you will be able to save hours of work and secure the best results by obtaining Blueprints Nos. 44 and 45 in the list below. The first of these shows in full size the hull, deck, bulwarks, and other essential parts of the hull. The second gives details of the masts, spars, sails, flags, guns, oars, lanterns, and various accessories. In most instances the drawings may be cut out and used as templates or else traced, and that saves the work of making full size drawings of your own. The coloring of each part also is indicated.



Complete List of Blueprints

ANY ONE of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

Blueprint Service Dept.
Popular Science Monthly
240 Fourth Avenue, New York
CITY

Send me the blueprint, or blueprints, I have underlined below for which I enclose cents:

No.	Title	Publication	Price
1	Sewing Table	Feb., 22	25c
2	Smoking Cabinet	Mar., 22	25c
3	End Table	Apr., 22	25c
4	Kitchen Cabinet	May, 22	25c
5	Shaving Cabinet	June, 22	25c
6	Arbor Gate and Bench	July, 22	25c
10	Porch Swing	Aug., 22	25c
12	Bench and Tilt Table	Sept., 22	25c
17	Bicycle Washer	Oct., 22	25c
13	Tra Wagon	Nov., 22	25c
14	Christmas Toys	Dec., 22	25c
15	Workshop Bench	Jan., 23	25c
16	Insulated Radio Cabinet	Feb., 23	25c
17	Coffee Chest	Mar., 23	25c
18	Phone Table and Stool	Mar., 23	25c
19	Grandfather's Clock	Apr., 23	25c
20	Flat Top Desk	Apr., 23	25c
21	Cultural Desk	Apr., 23	25c
22	Cabinet and Desk	Apr., 23	25c
23	Pergola Gate	May, 23	25c
24	Gating Table	June, 23	25c
25	Cancer Soiling Outfit	July, 23	25c
26	Baby's Crib and Pen	Sept., 23	25c
27	Kitchen Cabinet Table	Oct., 23	25c
28	Pullman Play Table	Nov., 23	25c
29	Tee Tea Cart, etc.	Dec., 23	25c
30	Tool Cabinet, etc.	Jan., 24	25c
31	Sewing Cabinets	Feb., 24	25c
32	Chinese Game Table	Mar., 24	25c
33	Dining Alcove	Apr., 24	25c
34	Garden Trellises	May, 24	25c
35	Simple Radio Cabinet	Oct., 24	25c
36	Rash Bottom Chair	Nov., 24	25c
37	Simplified Bookcase	Dec., 24	25c
38	Sheraton Table	Jan., 25	25c
39	Salem Chest	Feb., 25	25c
40	Desk in Sheraton Style	Mar., 25	25c
41	One Tube Radio Set	May, 25	25c
42	Three Stage Amplifier	June, 25	25c
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44	Ship Model Hull	Feb., 26	25c
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No. 231

Pocket Screw-Driver
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which complete the set.



Send for this handy
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IF you use tools at all, you will need this No. 231 Pocket Screw-Driver Set. And you are almost sure to find in the pocket size Goodell-Pratt Catalog one or more tools you will want to own. Take advantage of the special offer of the Screw-Driver Set and the book of tools. Mail the coupon.

The No. 231 Pocket Screw-Driver Set is a beautiful thing, nickel plated, buffed and handsomely polished. It contains a chuck, 3

screw-driver blades ($\frac{1}{8}$, $\frac{3}{16}$ and $\frac{1}{4}$ inch wide) and a reamer. The smallest blade gets even the smallest screws, such as those in a watch. All three tools are machined, made of best tool steel, hardened and tempered.

The reamer will ream out holes in soft metals and wood. With the tools enclosed in the hollow handle, the set is only $3\frac{1}{4}$ inches long.

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GREENFIELD, MASS., U. S. A.

Toolsmiths

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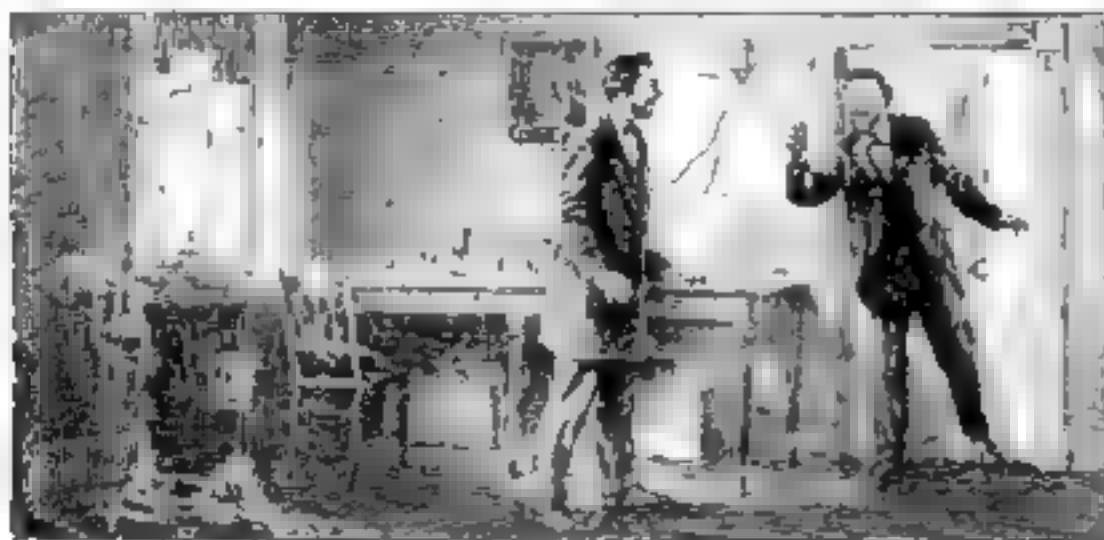
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From One Sentence To Millions

ON MARCH 10, 1876, a single sentence was heard over the telephone. Now, after half a century, 50,000,000 conversations are heard each day.

"Mr. Watson, come here; I want you," spoken by Alexander Graham Bell, the inventor, was the first sentence.

His first crude instruments had been tested by sounds and single words; the patent had been granted; the principle was established from which a world of telephones has since resulted. But at that time the telephone had not proved its practical usefulness—its power to command.

Bell's words, electrically transmitted over a wire, brought his assistant from another part of the building. And with his coming, the telephone became a dynamic factor in human affairs.

Since that first call untold millions of sentences have been heard over the telephone. Men have traveled vast distances in answer to its calls. The wheels of great industrial enterprises have turned at its commands. Everything that man can say to man has been carried to a distance over its wires and the thoughts and actions of nations have been influenced through its use.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES



IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

\$100 IN CASH PRIZES SEE PAGE 4 IN FRONT OF BOOK FOR DETAILS

Making It Easy to Build Things!

Men everywhere are finding it easy to build things of wood with Boice-Crane Bench Machines. Write today for our 64-page booklet describing Boice-Crane Circular Saws, Jig Saws, Band Saw, Mortiser, Jointers, Lathes and Drills.

14" Band Saw

Table 12x14
s. tilt 45 deg.
Saws 7-inch
stock. Four
blades 1/16
to
1/4-inch wide.
Bronze
Bearings.



8" Bench Lathe

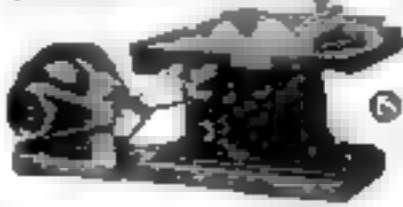
Does turning, drilling, threading, sawing, sanding, grinding and jig sawing in wood or soft metal. Swing 8-inch. Capacity 19 inches between centers.

All Boice Machines driven by 1/2 to 3/4
H. P. motor attached to light socket.

W. B. & J. E. Boice Dept. P. S. 34, Toledo, Ohio

Junior Saw

Does ripping, mitering, grooving, sanding, grinding and drilling with ease and accuracy. Table 10" x 12". Saws 2 1/4" stock. Blades 1/16 to 1/4". Makes moulding. Sold with or without motor.



What Tools Do You Need?

(Continued from page 89)

- Screwdriver bit, 1/4 in. or 1/2 in. (6)
- Bit stock drills for metal, 1/4, 1/2, 3/4, and 1 in. (4 or more votes each)
- Automatic drill with drill points (4)
- Hand drill with drill points (4)
- Screwdrivers, 4 in. and 8 or 10 in. (6)
- Pliers combination, 6 or 8 in. (6); round nose, 5 in. (5)
- Files—Saw-files, 5 and 6 in. (4) flat or mill bastard, 8 10 or 12 in. (6) round bastard, 6 or 8 in. (8) half round bastard, 6 or 8 in. (5) cabinet or wood file, 8 or 10 in. (5) cabinet rasp, 8 or 10 in. (5) auger bit file (5)
- Try square, 6 or 8 in. or combination square (6)
- Steel (framing) square (4)
- Sliding T-bevel, 8 in. (6)
- Boardwood folding rule, 3 ft. (5)
- Zigzag rule, 4 ft. (5)
- Cabinet scraper, 3 by 5 in. (6)
- Marking gage, wooden, or mortise gage (6)
- Dowel plate (5)
- Scraper or divider with pencil point, 6 in. (6)
- Bench, tryd. or pocket knife (4)
- Spokeshave (4)
- Drawknife, 8 or 10 in. (4)
- Pipe wrench, 10 in. (4) 16 in. (3)
- Monkey wrench, 10 in. (5) 12 in. (3)
- Tinner's snips (6)
- Levelling and plumb, 24 in. (4)
- Miller box, wooden or metal (4)
- Glass cutter (6)
- Tool grinder (5)
- Hand screws, one pair, 10 in. (8)
- Cabinetmaker's clamps, one pair, 3 ft. or 5 ft. (6)
- Burnisher for scraper (4)
- Saw set (4)
- Wrecking bar, small (4) File card or cleaner (3)
- Oilstone, artificial combination (4) Arkansas (natural stone) (3)
- Nail sets, 1/4 and 1/2 in. (6)
- Oilcan (6)
- Half hatchet (3)
- Soldering copper, 1 1/2 lb. (4) 1/2 lb. (3)
- Putty knife (6)
- Bench with quick-acting woodworker's vice (6)
- Cold chisel, 1/2 in. (6)
- Saw vice (4)
- Oilcan (6)
- Putty knife (6)
- Oilcan (6)

One point of interest in regard to this list is the fact that a wide difference of opinion developed as to the best lengths of saws. Two of the jurors thought that both a 22-in. and a 24-in. crosscut saw should be included in the list; two of the other jurors voted for a 26-in. crosscut saw, and the remaining two gave a vote apiece for a 22- and a 24-in. saw.

In the rip saw classification one vote was cast for a 22-in. saw, two for a 24-in. saw, and three for a 26-in. saw. The difference of opinion, of course, was due to the belief of some of our jurors that the amateur mechanic should follow the example of the professional woodworker and select a large saw so as to get the benefit of a long stroke, and if he wishes to do fine and delicate work, to buy a saw specially designed for fine cutting and sharpen it accordingly. The opposing view was that in doing small work, which comprises the majority of home workshop jobs, the amateur usually finds it easier to control a shorter saw. Boiled down, it is largely a matter of personal preference, provided the time element does not enter into consideration; for fast work a large saw should be used.

Finally the jury was asked to name the ideal home workshop outfit—a complete equipment such as will take care of the needs of the amateur mechanic interested alike in house repairs, general woodworking and all sorts of cabinetmaking.

The Ideal Home Workshop Outfit

- All the tools mentioned in the preceding list and—
- Tack hammer (4 votes)
- Light ball faced nail hammer, about 13 oz. in addition to nail hammer weighing a pound or a little more for ordinary work (3)
- Riveting hammer, 8 oz. (2)
- Upholsterer's hammer, 1/2 in. face (3)
- Soft mallet, rawhide or rubber (3)
- Crosscut saws, 22 and 26 in. in place of the single crosscut saw mentioned in the preceding list (4)

(Continued on page 93)

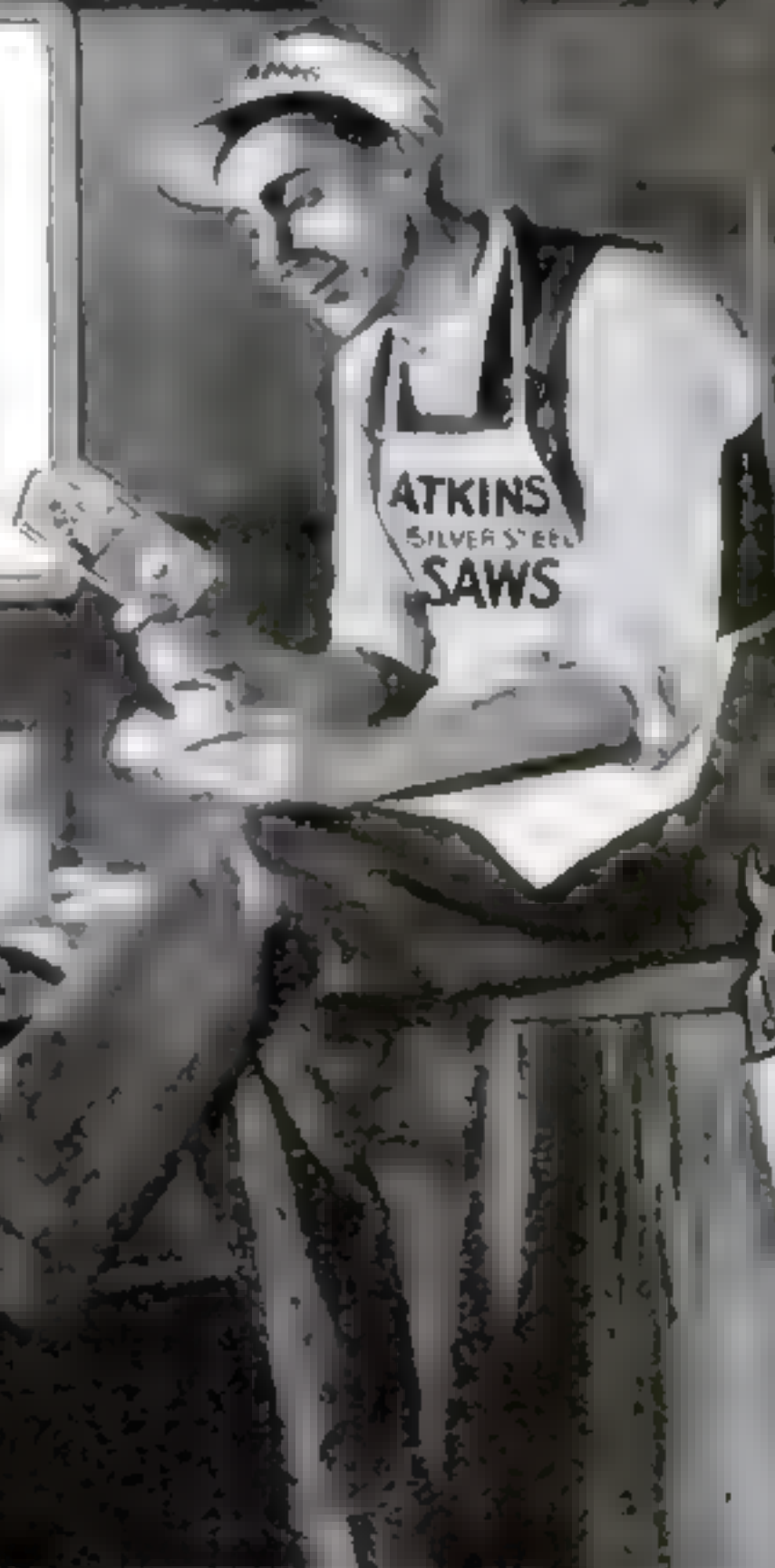
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THESE Sargent Planes are popular tools with carpenters, manual training instructors and students, and chaps with home workshops. The reason is not hard to find. They are professional tools through and through—time-tested and proved most worthy. Carpenters find them superior for the most difficult jobs. Many school and home work benches can also testify to the quality of the work they do. They resist wear, seldom if ever needing repair or replacement.

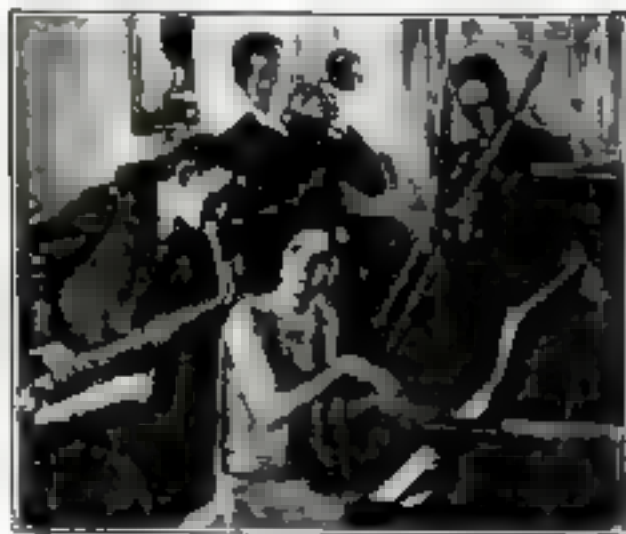
The Sargent Auto-Set Bench Plane No. 714—the larger of the two illustrated—is particularly easy to adjust. The cutter of wear-resisting chromium steel can be removed, resharpened and replaced without changing original adjustments. How cleanly and quickly it cuts—across

the grain, against the grain and over rough or knotty surfaces, with *never the slightest chatter*. The Auto-Set is quite a time-saver—a tool of delightful “feel” and balance. It makes the big jobs easy.

The Sargent Steel Block Plane No. 5206 is a convenient plane for the smaller jobs. The low angle of cutter particularly fits it for end work. The cutter here, as in every Sargent Plane, is of chromium steel—selected because of its unusual edge-holding ability.

These two planes will take care of practically every job you'll ever have. They are versatile, dependable, lasting—and really most economical. You'll be proud to own both. See them at almost any good hardware store and write us now for free descriptive booklets.

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State, County _____

Use pencil, please!

The Home Workshop

How to Make Your Own Screens

(Continued from page 74)

amateur to use a "layout rod"—a stick of wood upon which have been marked the dimensions of the opening. Be sure to mark carefully the location of the middle bar and the total length and width.

The parts of the frame then are marked. About $\frac{1}{8}$ in. is added to the height for fitting, but the width should be exact.

It is best to fasten the side pieces in the vise or a clamp (Fig. 8) and mark the extreme length of both at once. Next, use the cross pieces to lay off the exact location of the ledge or recessed butt joints

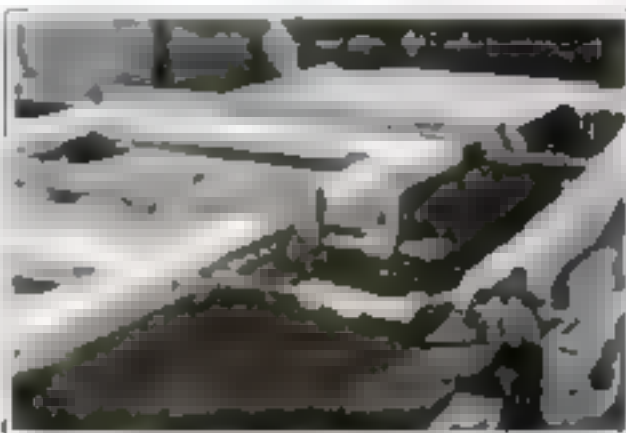


Fig. 10. Boring $\frac{1}{8}$ in. dowel holes in a door frame after the parts are clamped together

(these are shown most clearly in the central photograph on page 74) and draw lines across with the try-square. Continue lines down on each surface for a distance of $\frac{1}{8}$ in.

Using a marking gage set to $\frac{1}{8}$ in., score lines as shown in Fig. 3 from the extreme end of the pieces to the mark for the cross rails. Do this on both sides and also mark for the center bar. If there is any likelihood that the side pieces are uneven in width, the gaging can be done from the outside edge with the gage set at $1\frac{1}{8}$ in., or $\frac{1}{8}$ in. less than the width.

Place two or more pieces in the vise, make cross cuts down to the gage lines (Fig. 4), and then rip off the wood to be removed (Fig. 5), taking care to cut close to the line. If the surfaces are not true, a chisel may be used to straighten them and a chisel must be used, of course, to remove the wood for the middle bar.

Next, cut the cross pieces to the exact length required, preferably in a miter box, as the ends must be square. After the frame has been tested both for size and squareness, nail it with eightpenny finishing nails, as shown in Fig. 6.

In this work, as in all other exposed to outdoor weather conditions, it is well to apply white lead or thick paint liberally to the joints before nailing them together.

Lay the frame on the bench and smooth both sides with the plane, particularly over the joints, and rub the whole surface with rather coarse sandpaper. (Fig. 7).

Both window and door frames should be painted, oiled or varnished before the wire cloth is applied. Dark green and black are practical colors, and do not show the dirt. Apply a thin priming coat and one or two coats of the ready mixed screen paint. At least three coats are necessary if frames are to be painted a good white.

The frame is now ready for the screen cloth, which preferably should be copper or some alloy that will not require the frequent painting that is needed to preserve both galvanized and ordinary black wire screening. The mesh should not be larger than No. 16 and finer weaves can be obtained if conditions require it. Extra heavy grades for screen doors are available at well-stocked hardware stores.

With copper insect screen cloth, copper tacks are essential, because when other metals come in contact with copper, corrosion may occur. Tacks should be $\frac{1}{8}$ or $\frac{1}{4}$ in. long. For galvanized and black wire cloth use No. 2 $\frac{1}{4}$ common blued tacks.

The usual method of stretching wire is to tack one side and pull the opposite side as tightly as possible; then, without much stretching, tack along the third side, and finally tack the fourth side, stretching tightly. If the screen cloth has been roughly handled and kinked, it is practically impossible to stretch it perfectly flat.

Amateurs sometimes have difficulty in the stretching process, but it is a simple matter to obtain all the pressure necessary by the method illustrated in Figs. 8 and 9.

First nail a strip of wood firmly to the bench and tack the end of the wire cloth to it. Butt one end of the screen against the strip and elevate the far end on another strip of wood. Tack the wire at the far end, pulling it taut as possible (Fig. 9). Then remove the support and lower the frame into a horizontal position. If this

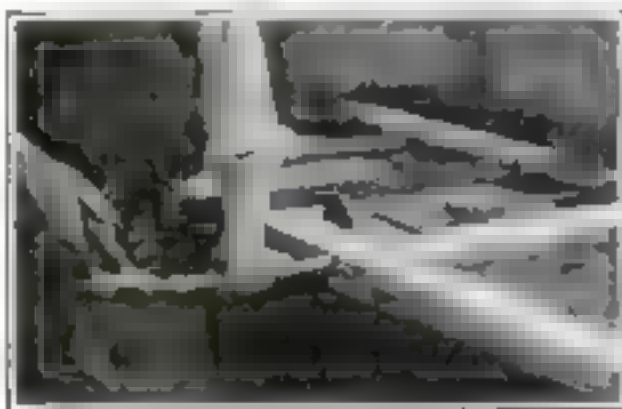


Fig. 11. After the joints and holes have been coated with glue, the dowels are driven home

does not stretch the wire sufficiently, thin wedges can be driven between the screen and the end strip before tacking the wire at that end, that is, the end adjacent to the wedges. The remaining sides then may be tacked as described above.

Screen molding, either half round or of other shapes, may be bought. Plain strips $\frac{1}{4}$ by $\frac{1}{4}$ in. will serve, and they can be made by hand. The corners may be mitered or fitted with a butt joint. If the latter is used, the short pieces are fitted against the upright ones.

The moldings are nailed in place with $\frac{1}{4}$ in. brads. The wire edges may be trimmed with an old but sharp chisel or knife before or after the molding is applied.

A substantial screen door can be made also by the same process, except that it is

(Continued on page 96)

You, too can use this dependable material

When your plaster ceilings crack or fall.....when you need more space in your attic.....when you want to do "odd jobs"..... See how Upson Board will help you in your home, store or office



UPSON Board comes in big panels of tough processed wood fibre that apply right over old plaster or direct to

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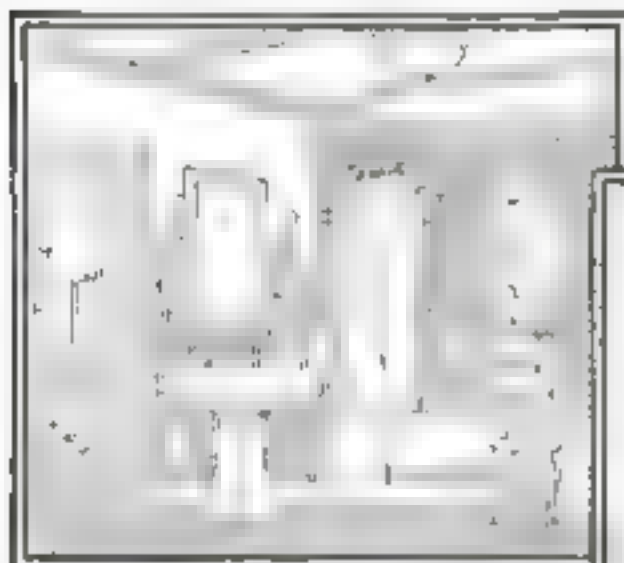
For ceilings—there is nothing better at any price. It is not dangerously heavy.

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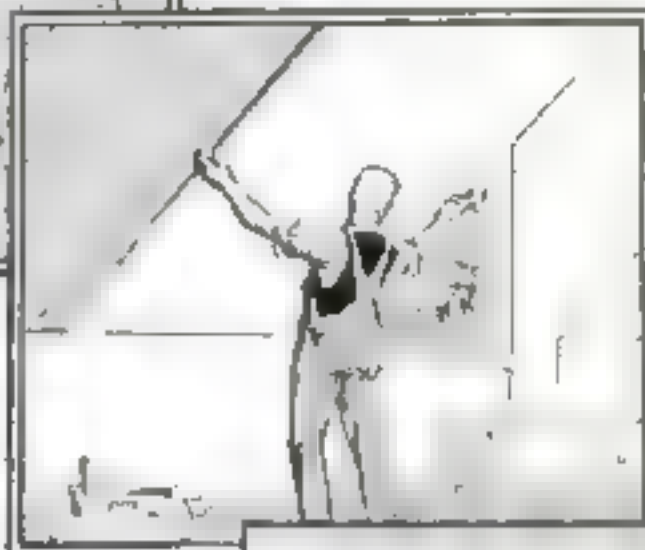
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For sheathing "Heat and cold proofing as nearly perfect as possible." J. C. Franklin, Nebraska.



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You'll be surprised to see how easily you can use Upson Board to make waste baskets, table tops, cabinets, doors of other useful articles.

In fact, there is almost no limit to Upson Board uses. Walls,

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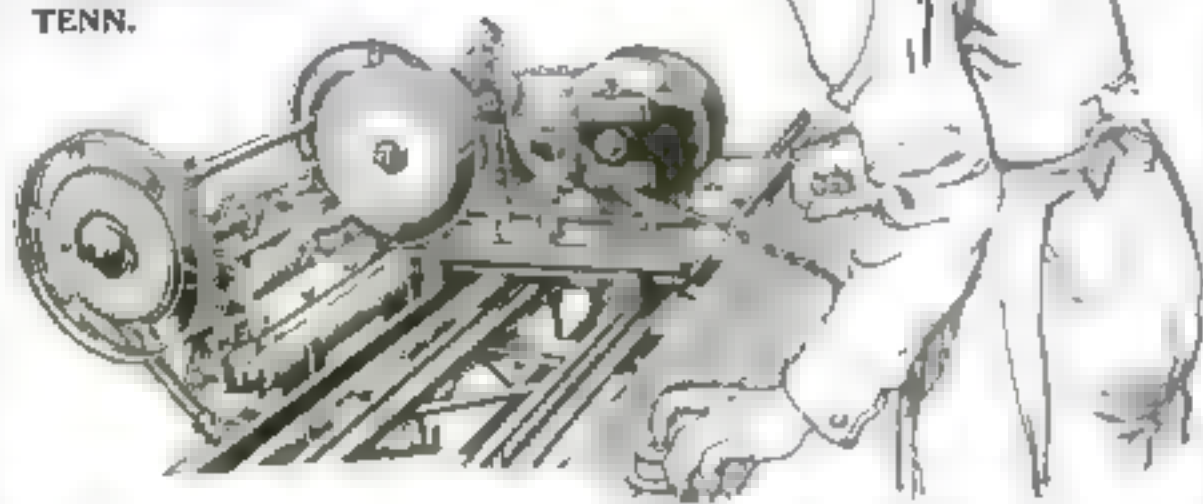
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Not merely another toroid but a carefully designed air core transformer—the product of the inventor of the Nameless and Counterphase circuits. When used in an efficient circuit the Torostyle reduces pick up of local signals as well as intercoupling and stray feed backs.

The terminals are accessible for easy wiring and the general appearance of the coil commands instant attention.

The Torostyle is very efficient when used in the Counterphase circuit—in fact it was designed to be used with it. The Torostyle and the Counterphase circuit have done much to add a Bremer Tully prestige.

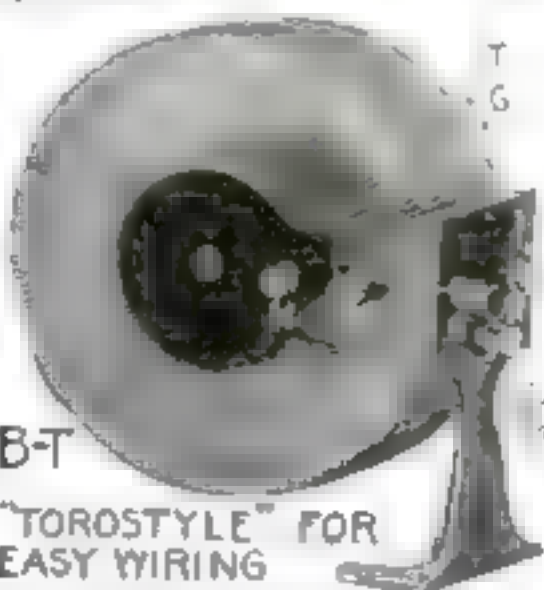
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The Home Workshop

How to Make Your Own Screens

(Continued from page 89.)

necessary to use dowels in the joints. The stock used for doors should be $1\frac{1}{4}$ or $1\frac{1}{2}$ in. thick. The stiles (uprights) should not be less than $3\frac{1}{2}$ in. wide, the top rail at least the same width, the bottom rail 8 in. or more, and the middle rail from 4 to 5 in. A door is laid out $\frac{1}{4}$ in. wider than the opening and from $\frac{1}{4}$ to $\frac{1}{2}$ in. longer.

After the joints are fitted in the same manner as has been suggested for window screens, lay the door on some cross pieces on the bench and apply clamps as shown in Fig. 10. Test for squareness and see that there is no twist in the frame. Then mark for the dowels, using a marking gage and try-square, and bore $\frac{1}{2}$ -in. holes with an auger bit as shown. Let the bit go into the cross rails not less than 2 in.

Two dowels should be used in the top and middle rails and three in the bottom rail. If dowels are not to be obtained readily at the lumber yard or hardware store, they can be made by hand.

After all the holes are bored, remove the clamps and put glue in the joints and in the holes of the cross rails. Then assemble the parts, put the clamps on, apply glue thickly to the dowels and drive them in place as shown in Fig. 11. Be sure to plane a small flat along the dowels or cut a notch or saw kerf along them beforehand so that the air and surplus glue can escape. Otherwise you are very likely to split the cross rails.

The door then should be smoothed and the screen wire applied as already described. It pays as a rule, especially if there are children in the house, to protect the lower part of the door with a panel of heavy wire cloth, fastened next to the insect screen cloth with staples.

Metal braces for doors, spring hinges, corner irons, latches, and stops are usually obtainable at hardware stores.

Porch screens can be made, of course, exactly as described for doors and windows, but it is advisable not to have the sections wider than 8 ft.

The method of fitting and hanging window screens is exactly the same as that described for storm sash by F. E. Tustison in an article on page 69 of the November, 1925, number of POPULAR SCIENCE MONTHLY.

How to Identify Door Keys without Looking at Them

DOOR keys may be identified readily by touch alone, if marked in any of the ways illustrated. In A, a hole is drilled large enough to be felt easily. In B, a



piece of fine wire is wrapped around the key and the ends are soldered. In C, one or two holes are drilled and rivets or small bolts are inserted.—HAROLD SMITH

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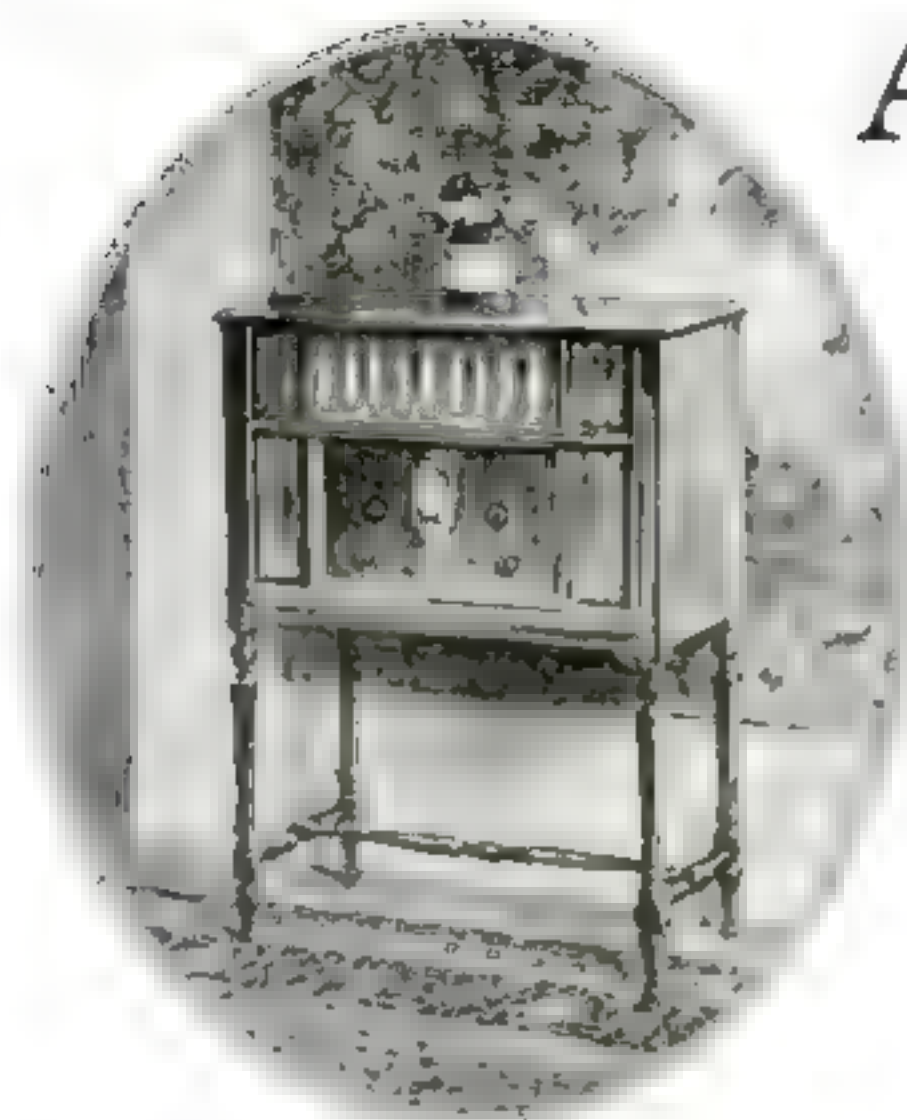
In beauty, too, a Kolster offers the ultimate. Miss Elsie de Wolfe, the world's greatest authority on interior decoration, is designing Kolster cabinets.

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The Home Workshop

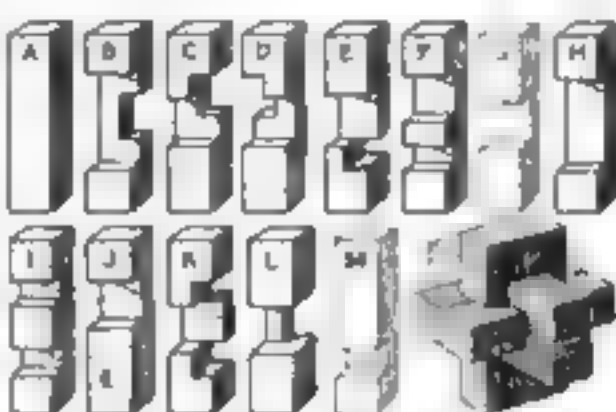
Solving the Famous Block Puzzle in Sixteen Ways

By ARTHUR L. SMITH

SO COMMON is the block puzzle that nearly everybody has tried at some time or other to put one together. It may be thought that all block puzzles are alike. The truth is that they may be of almost endless variety. The whittler may design new ones at will.

The puzzle usually consists of six pieces, $\frac{1}{2}$ by $\frac{1}{2}$ by 2 in. One is a plain block, but the others are cut so that all may be fitted together.

The illustration shows how the various pieces may be formed. A is the plain key



How to whittle the pieces required for sixteen different solutions of the block puzzle

block; it is the last piece to be put in and locks the others in place.

All the cuts in the other pieces are $\frac{1}{4}$ in. deep and $\frac{1}{4}$, $\frac{1}{2}$, or 1 in. long. They are always $\frac{1}{2}$ or $\frac{1}{4}$ in. from the ends. C and D are alike, except that one is right and the other left.

With a set of 18 blocks, three of B, two each of F, H, and J, and one each of A, C, D, E, G, I, K, L and M, 16 different puzzles may be formed. The order given below is that in which the blocks may be taken for putting them in place.

I, D C B are first fitted, then E B, and the two latter are slid into place, leaving an opening for A.

II. F G B B B A III. J B F B B A.
IV. I H H B B A. V. J K B H B A.
VI. I L B B B A. VII. B B H K G A.
VIII. H H F B K A IX. F H F B B A

All the above combinations have the key block A. In the two following there is no key block and when the joints fit snugly, they are almost as difficult to take apart as to put together.

X. J G B B are fitted, then J K and the latter inserted.

XI. J E B H first; then B M

A number of combinations may be formed that leave in the center a hollow space that is not discernible when the puzzle is put together. The following are examples

XII. D J B B B A XIII. F H B H B A. XIV. J B B H B A XV. F H D B B A

XVI. J E B H first, then B and I or F (no key block).

All the foregoing, except two, were originally designed, but others may have hit upon many of the same combinations. It is quite possible that by selecting different blocks out of the series, other combinations differing from those given may be formed. It would take too much space to describe the solutions more clearly here, but that is just as well. The reader who makes any set given will have the pleasure of puzzling it out for himself.

Puzzle fans the country over will be glad to know that this is only the first of a series of articles by the Rev. Arthur L. Smith. To those who are not familiar with his reputation as an authority on puzzles it is sufficient to say that he was for some time the editor of the magazine of the National Puzzlers' League. He has the happy faculty of describing easily made puzzles that will interest the beginner and at the same time amuse the veteran puzzler. This article is a good example, because some of the solutions are simple and others intricate. If you are an old hand at the block puzzle, try solution No. V first.

Walnut End Table with Handmade Spiral Legs

IN MAKING by hand the legs of the walnut end table or console table illustrated, I used a method that has been previously described in POPULAR SCIENCE MONTHLY.

The top of the table was cut from a piece of walnut 1 by 10 by 18 in. The front corners were cut off as shown and the top planed, scraped, and sanded. It would have been possible, of course, to make the top semi-circular.

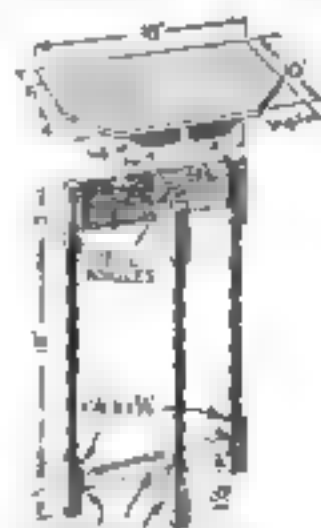
Stock $1\frac{1}{4}$ in. square was used for the legs. Each end was left square for 8 in.; the remainder was carved in a spiral. In making legs of small diameter it is best to use a comparatively long pitch, so a strip of paper about 2 in. wide was

wrapped around the legs to serve as a guide for marking spirals.

The legs were attached to the frame with mortise and tenon joints and the top fixed in place with three small steel angles.

A table of this type may be given either a well rubbed and somewhat dull varnish finish or a shellac and wax finish.

—R. E. DEERING.



ALL JOINTS ARE MORTISED AND TENONED

How the parts of the table are assembled

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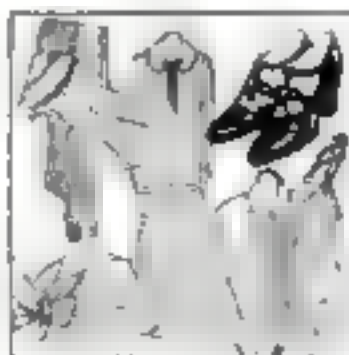
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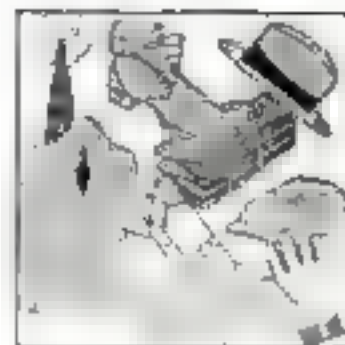
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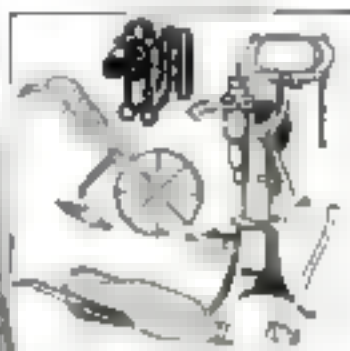
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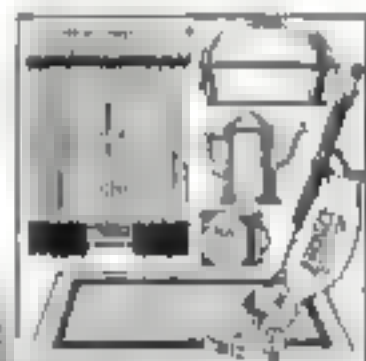
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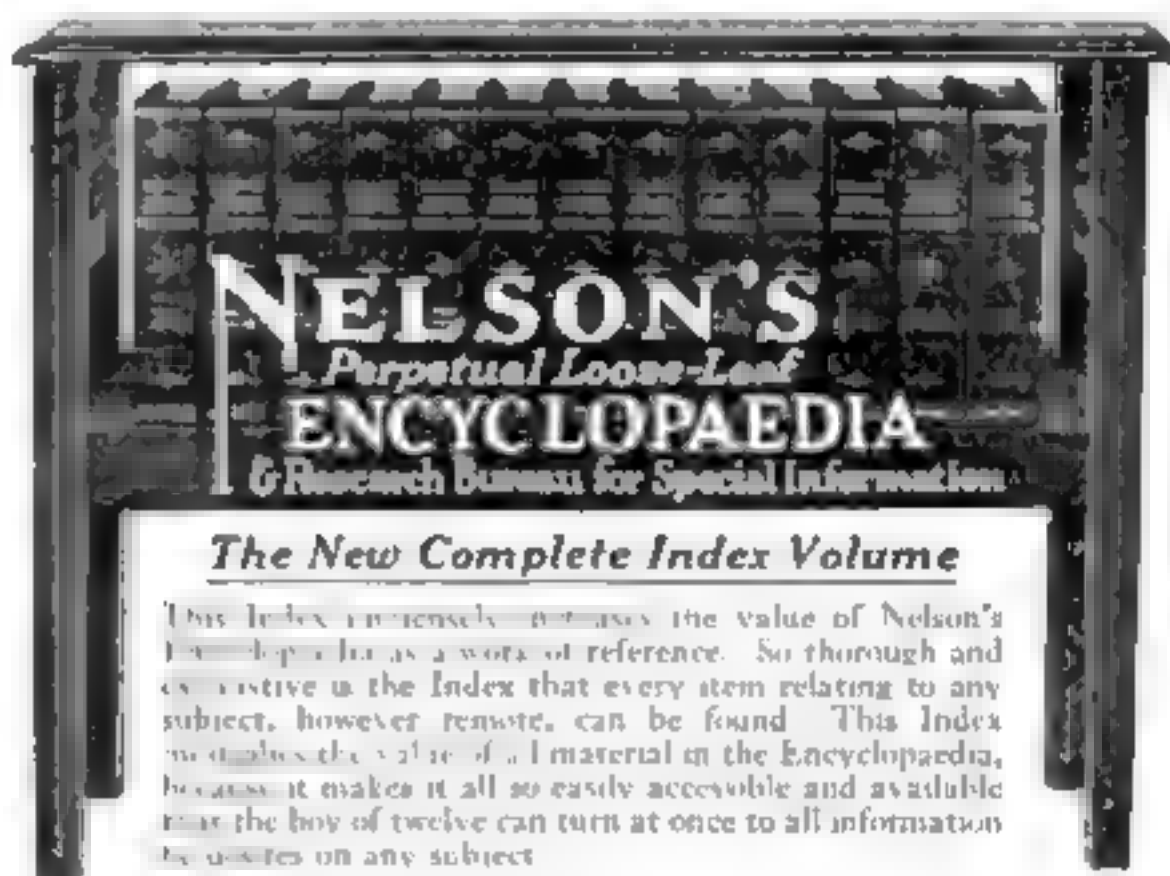
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When he was ten years old, his father died and he had to take over the business. He was only a boy, but he was very smart and he knew how to run the business. He was a very successful organ builder and he had many famous organs built for him.

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Furniture Refinishing

(Continued from page 101)

We turned our attention the next day to the table and removed the top from the frame and the drop leaves from the top.

"Now for the varnish remover," I said. "But, Mr. Waring, one of the men told me that I ought not to use varnish remover. He did it once and it burnt the work and his hands, too. He told me to be sure and scrape the whole job."

"Good advice once upon a time, Dan, but not any more—at least, not as a usual thing. The only removers your friend knew contained potash or lye. The paint chemist now mixes acetone, benzol, alcohol, and other materials and lets them dissolve or soften the old finish.

"When I apply this remover, notice that I don't work the brush very much. Alcohol and similar liquids evaporate very quickly, so the manufacturer has added a solution of ordinary paraffin to his varnish remover. If you look closely you will see it forming a blanket on top of the remover I have just spread. To do much brush work will result in breaking up the blanket and then the solvents will escape.

"See those wrinkles forming like rows of tiny blisters. Wait until the surface is wrinkled like that, or, as sometimes happens, simply gets soft clear down to the wood. Now take this wide putty knife or scraper and lift off the waste varnish and wipe the knife on a quarter sheet of old newspaper. On these turned parts use a handful of coarse steel wool—Number One will do. Clean off all the old varnish and then take some scrap burlap and wash the table with denatured alcohol to get rid of the last traces of grease and varnish.

"One thing I do want you to remember, Dan, is this: Don't leave any of these rags or papers lying around here or at home to start spontaneous combustion. Put them in the stove and burn them."

The next step was the sandpapering of the frame with No. 34 or No. 0 flint paper backed with a piece of 1/4- or 1-in.-thick rubbing felt. Care had to be taken not to cut through the veneers.

Dan asked whether veneered mahogany was as good as solid wood.

"That is an old, old question," I told him. "Try and look at it this way. See that beautiful crotch grain you just sanded so smooth? Now we can cut that one-sixteenth inch thick to be glued on a cheap wood core and get ten or more sheets an inch from the log.

THINK how many more beautiful mirror frames can be made from these veneers than from one-inch boards. Then, too, veneered work is generally stronger than solid and does not warp or split like solid stock. Very few people could afford to have solid crotch mahogany furniture."

The following day Dan came in so early that I noticed the last swallow of lunch disappearing as he entered the room.

Dan had observed that the veneer looked rather light after being sanded.

"I was wondering last night how we



Burning colored shellac into holes too small to patch. If prepared stick shellac is not available, melt flake shellac in a tin cup, add dry colors, and pour into a tin mold to cool. Colored sealing wax also can be used.

could change it," he said. "I went out with mother to see one of her friends who has a couple of nice pieces of mahogany. Her pieces were rather darker and quite red. Brown would suit me better."

I was glad Dan had used his eyes so well. "You are right about the red tones," I said, "for here is a piece of Honduras mahogany more than a hundred years old, which I keep as a 'pure quill' sample of color. Notice that the general tone beneath the varnish is a brown—rather medium in tone, carrying a slight tint of red, while underneath is a decided base of orange that livens the whole and gives it the real character and golden undertone peculiar to good, honest mahogany. It is hard to find in the black-browns and red-blacks on the market today anything remotely resembling the color as time has produced it on the genuine material. That, however, is no reason why you should spoil your pieces by trying to match present-day shades, since the older sample which I keep is accepted as correct for this class of staining."

WHILE Dan went ahead with his sandpapering, I made up a hot water stain in the proportions of 1 oz. of brown mahogany water stain powder to 1 qt. of water. Dan asked why I mixed my own stain.

"Because a really clear tone and finish can be produced only when a water stain is used. If you find at any time in the future that you cannot obtain water stain powders at your paint store, you will have to get a spirit or oil stain instead. In that case, follow the directions printed on the can or bottle. Prepared stains generally are too dark and need to be diluted, but manufacturers give full instructions."

(Continued on page 104)

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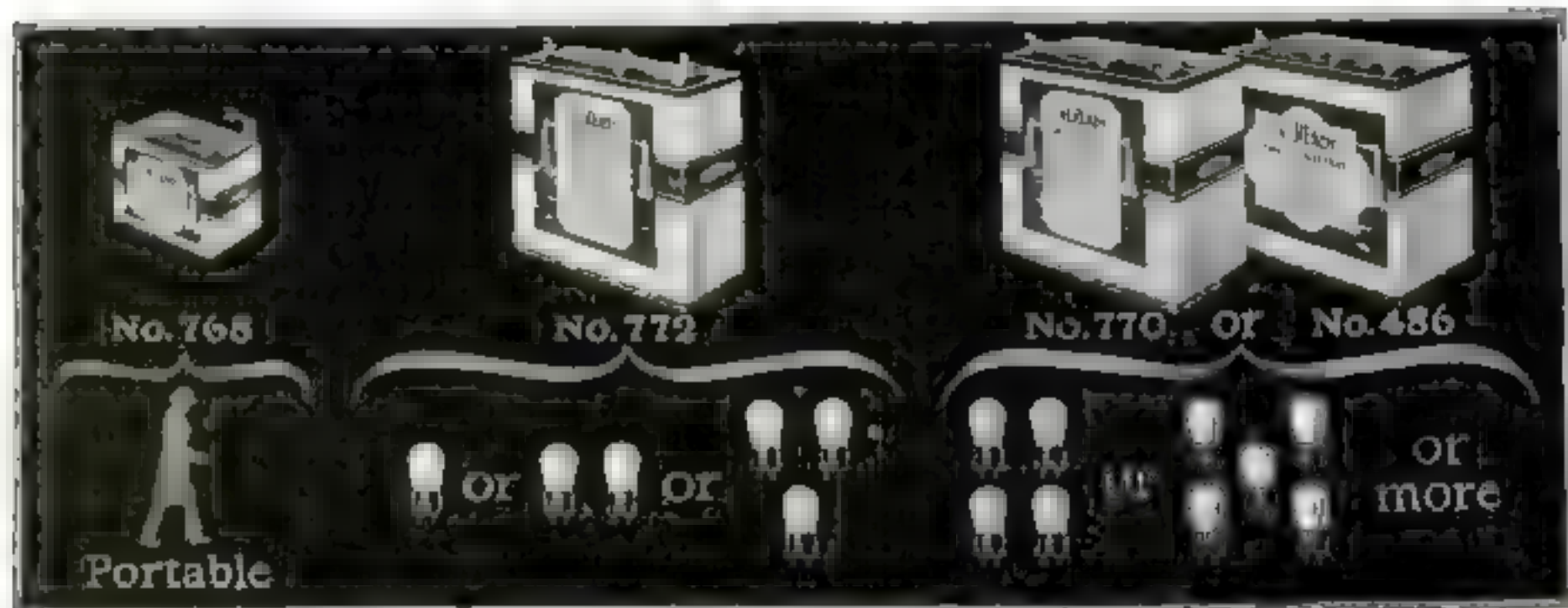
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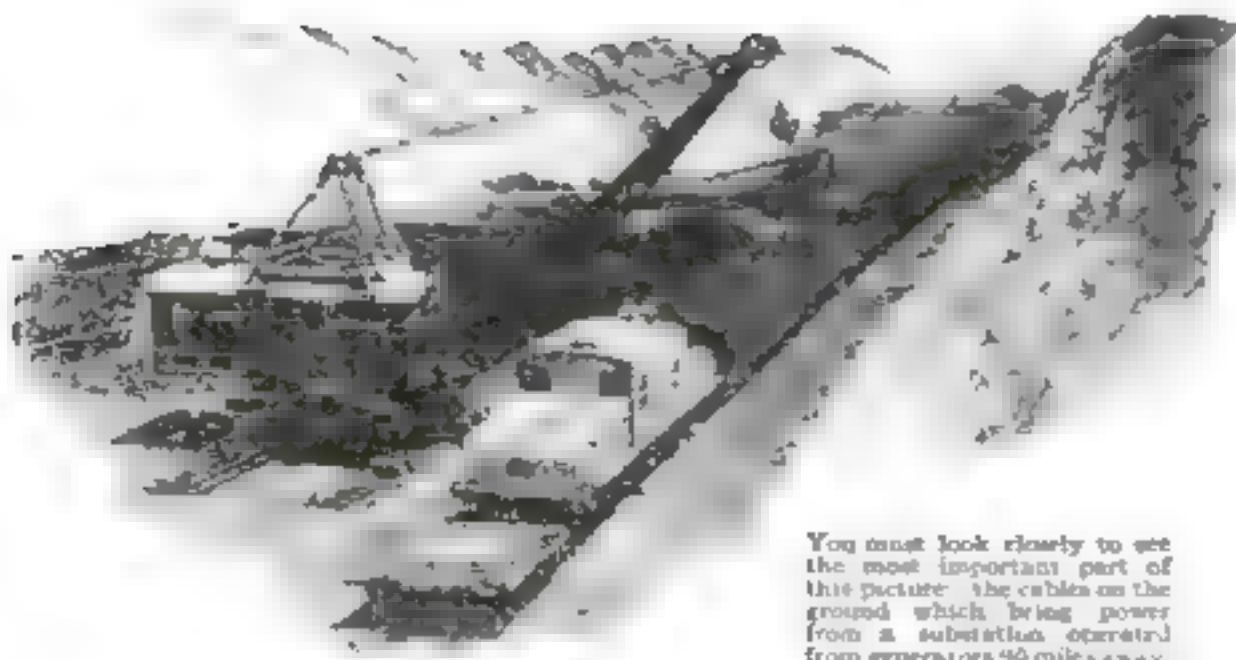
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Furniture Refinishing

(Cont. from page 155)

Dan had finished off the frame with No. 4-0 sandpaper. Upon close examination, we found two small holes through the veneer that had been missed in the patching process. These were filled by taking a stick of medium mahogany shellac, heating a soldering iron enough to make the shellac run without bubbling, and melting enough shellac to fill each hole. The tip of the iron was held just above the work. When the shellac had cooled, the surplus on top was cut off with a knife and then the patch was sanded level and true with a nearly worn-out piece of fine sandpaper.

Dan rapped the back of the frame with a brush handle to get rid of the dust in the pores after I had explained that dust left in the wood might give a muddy shade.

A 2-in. black China bristle brush is about right for staining a small piece. The brush should be dipped $\frac{1}{4}$ in. into stain.

"Apply quickly and freely to the veneer," I told him; "but be careful not to touch the rosewood outband, since that should be left in the natural color. Now take the damp brush and even up the whole job while it is still wet and put the frame aside to dry overnight. Next, sandpaper your table, being sure to sand only in the direction of the grain. If you sand in circles or across the grain, the result will show up like cat scratches on the back of your hand after the wood is stained. If there are any tight bruises you can not sand out, steam them up with a hot iron and wet felt. Let dry and then sand level.

"Use a wood block to back up your sandpaper when sanding the top and drop leaves, since the surface must be absolutely true before varnishing. Be sure to round the edges a trifle, so that the stain and finish will not wear off. Then tomorrow we can begin the real processes of building up the finish, which will bring out and preserve the beauty of the wood, so that your grandchildren can say, 'Granddad Dan finished that mirror when he was an apprentice'."

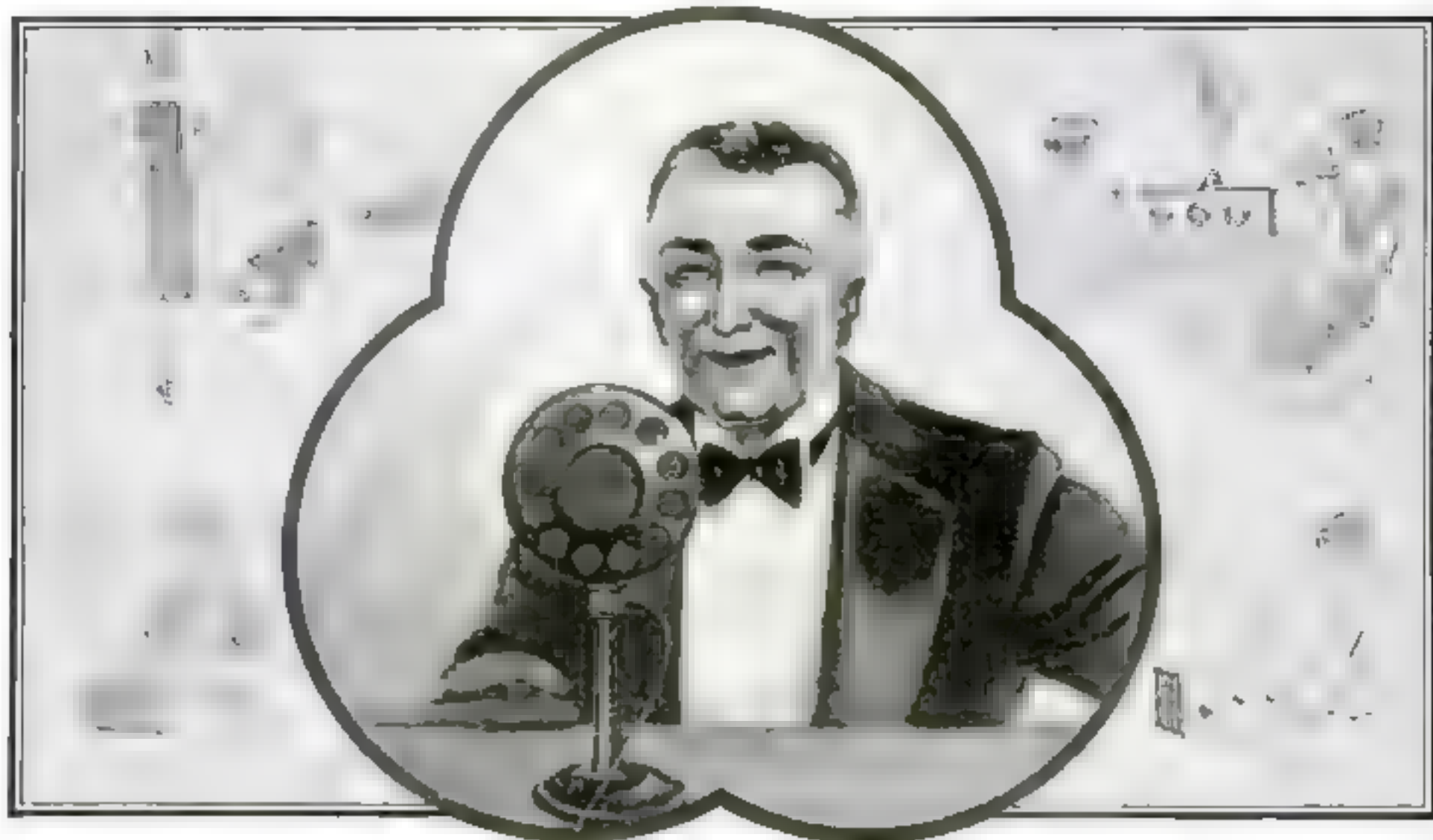
Varnishing will be the subject of Mr. Waring's second article, which will appear in next month's issue.

Holder for Pens and Pencils

THIS little flower holder or "bud vase" serves as a handy pen and pencil holder for a desk or drafting table. The holders may be obtained in various colors and shapes, ranging in price from 10 cents up. What they are really for is to hold the stems of cut flowers.—DAVID J. MORRIS.



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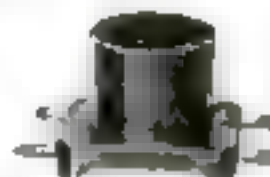
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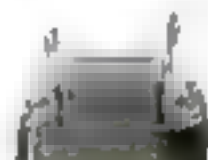
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Microfilm Radio Corp., Condenser and Lens



Carter Radio Co., Flat Plug

BAKELITE

THE MATERIAL OF  A THOUSAND USES

"The registered Trade Mark and Symbol above may be used only on products made from materials manufactured by Bakelite Corporation. Under the symbol 'B' is the registered logo for Bakelite or Bakelite quality." It signifies the highest quality of goods and better use of Bakelite Corporation's products.



The mark of quality whether you buy or build. Insist upon C-H radio products for highest efficiency in your new set.

"That's Not Only a Beautiful Set, Fred; It Has Been Carefully Designed—Those Sockets Prove It!"

A list of some of the prominent radio manufacturers using C-H products

Amer. Apparatus Co.
American Bosch Magneto Co.
Astral Radio Corporation
Bulwer Radio Corporation
Christie Radio Co.
Cresley Radio Corporation
Dayton Van & Motor Co.
Dittograph Products Co.
Dittler & Son, Inc. & Radio Corp.
Edwards, Inc.
Franklin Electric Radio Corp.
General Corporation
Griffiths Bros. Inc.
Allen T. Hammons
Hunting Mfg. Co.
Howard Radio Co.
The Keyport Laboratories
King Electric Mfg. Co.
Radio Radio Corporation
Lafayette Radio Inc.
Mingos Electric & Radio Co.
Malone-Lemmon Laboratories
Owen L. Martin Co.
Wm. J. Mumford
Newport Radio Co.
Pfeiffer Mfg. Co.
Philadelphia Storage Battery Co.
Radio Master Corp. of America
The Radio Company Co.
M. B. Radio Co.
Robbins Radio Co.
Sigma Electric Co.
Silver-Marshall Co.
Simplex Radio Co.
S. E. Thompson Co., Inc.
J. S. Timmons
Workrite Mfg. Co.
Zebith Radio Co.

"YOU can always tell a carefully designed set by its parts"—any radio set manufacturer will tell you so.

That's why you find so many sets on the market today with C-H sockets, rheostats and switches. For manufacturers know by careful testing the advantages that hundreds of thousands of radio fans have found in C-H features through years of "building their own."

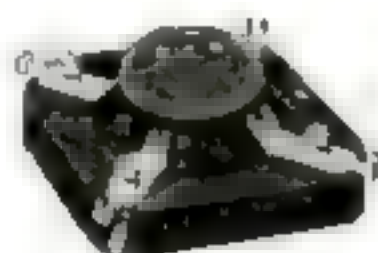
C-H Low Loss Sockets, for instance, settle once and for all one of the most annoying of all set troubles—loose contacts at the tube prongs. In C-H sockets each tube prong is firmly held in the one piece, silver-plated, double grip contacts. Jarring of the set or corrosion cannot alter the perfect contact. They are easily wired and give a finished appearance to any set.

So whether you buy or build—look for the C-H trade mark. It is a guarantee of satisfaction.

THE CUTLER-HAMMER MFG. CO.

Member Radio Section, Associated Manufacturers of Electrical Supplies

MILWAUKEE, WISCONSIN



The New C-H UX Socket

for the new UX tubes. Same C-H one piece, low loss SILVER plated, double grip contacts as in the C-H original low loss socket with the ORANGE shell. Heat proof Thermoplastic body—terminals cannot loosen under heat of soldering iron.

Spring washers under binding posts prevent loosening of hex nuts and assure tight connections. The hex nuts are slotted to permit tightening with screw driver or wrench.

The lugs at the end of the contacts are designed for easy soldering and may be bent down for under wiring.

CUTLER-HAMMER
Buy Your Radio Parts by Name

New "Easy Pay" Plan

PUTS ANY LATHE IN YOUR SHOP

Send for big Free Catalog and select the lathe you want. Make one small payment down and we ship the lathe to you. You may return it or pay for it in convenient monthly payments. In the way lathe.

Quickly Earns Own Cost

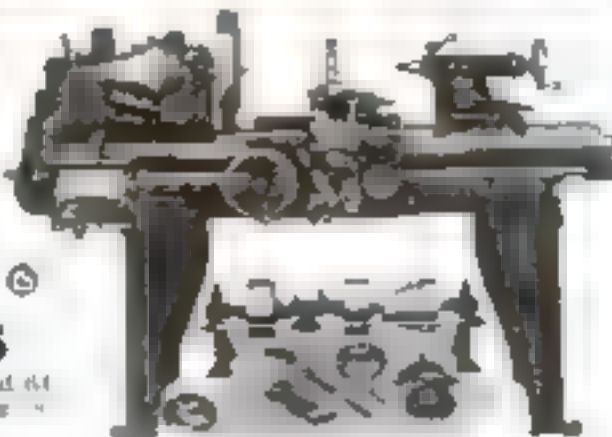
by what it saves and makes for you. You don't feel the cost at all. The high quality of

SOUTH BEND LATHES

is recognized everywhere. \$3,000 in use in U. S. and 64 Foreign Countries. Write for Free Catalog showing styles and sizes.

SOUTH BEND LATHE WORKS

818 E. Madison St., South Bend, Ind.



13 inch Swing over Bed, 5 ft. Bed Quick Change Gear Lathe, Net \$2,100.15 Price \$397. Easy Payments if desired.

1 Made 21st In Five Hours
—Writes Peter Wormer, III,
Madison Shirt Mfg. Co.,
152 Broadway, New York

Write for Free Samples

MADISON SHIRT MFG. CO., 152 Broadway, New York

SENSATIONAL SALE

Here is a bargain—a genuine I. C. Smith, Inc. typewriter, guaranteed for 5 years. **SEND NO MONEY** now. We'll send you a typewriter on a 30-day trial. If you like it, we'll send you the rest. If not, we'll take it back. No questions asked. Write for details. I. C. Smith Typewriter Sales Corp., 360 E. Grand Ave., Chicago.



Save Your Knuckles!

DID you ever stop to consider how much "finger-grief" a handy little Luther bench vise will save you? On top of that, it makes any tinkering job easier. You can work better with your other tools with a Luther Vise to help you.

Its sturdy steel jaws open farther than the jaws of any other vise of the same size—and the extra heavy steel feed screw assures a tight, unyielding grip that holds. The slide bar, upon which so much depends, is panelled to give almost double strength. Jaws are $\frac{1}{8}$ " to $\frac{1}{4}$ " wider than most vises. Four popular sizes— $1\frac{1}{2}$ ", 2", $2\frac{1}{2}$ " and 3" jaw spread.

Write for free copy of booklet:

Tighten L. P.

LUTHER GRINDER MFG. COMPANY
Department A, Milwaukee, Wis.

Also makes: Sweet of Luther high quality tool grinders.

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QUALITY-BUILT VISES

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This FREE Book Will Prove It!

Thousands of people of all ages, in all walks of life, are now playing Hohner Harmonicas for entertainment, education and inspiration. Thanks to the new instruction book they are enjoying the popularity that comes to those who can play this fascinating musical instrument.

If there is any greater satisfaction than listening to good music, it is surely that of being able to play it. This Free Instruction Book, containing charts, pictures and popular musical selections, will enable you to play the Hohner Harmonica with an ease that is most surprising. Ask your dealer for a copy today; if he cannot supply you, write direct to M. Hohner, Inc., Dept. 122, 114 East 16th Street, New York City.

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Sell Hohner Harmonicas
50¢ up.

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Tying an Underwriters' Knot in a Lamp Cord

By GEORGE A. WILLOUGHBY

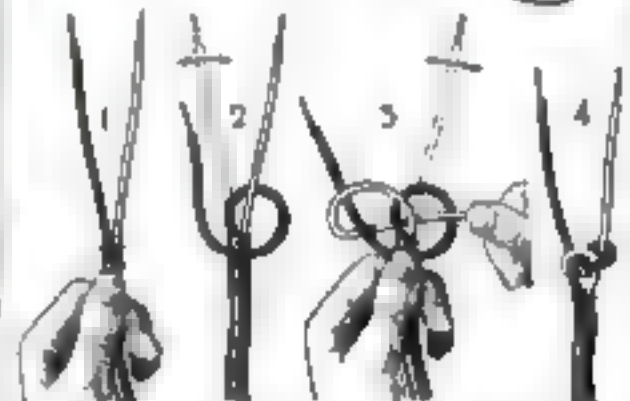
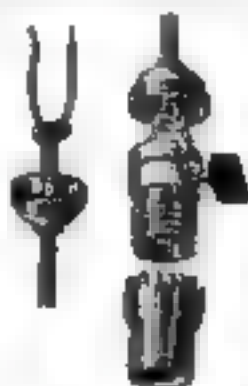
Supervisor of Electrical Work, Arthur Hill Trade School, Saginaw, Mich.

ONE of my neighbors was in his cellar workshop putting the finishing touches on a little lamp stand for his reading table when he received a peremptory summons to the living-room. "Look, dad," his son exclaimed, "I just pulled a little on this extension cord and the wires came right out of the attachment plug!"

"That's queer," he said. "You must have tugged pretty hard."

But it wasn't the boy's fault, as I told the father later on, when I showed him how to prevent the recurrence of such an accident. The tying of a comparatively simple knot will eliminate trouble of this kind. The knot is used when assembling new extensions, lamps, or fixtures, so that to know how to tie it is the first essential in wiring work of the kind the home worker has to do most frequently.

The knot is commonly known as the underwriters' knot because the code of the National Board of Fire Underwriters requires it to be used. The steps in tying it are shown in the illustration.



Steps in tying an underwriters' knot are shown in Figs. 1 to 4. How the knot is used in wiring a socket is shown in the upper view.

1. Twist or split the cord in which the knot is to be tied (Fig. 1). Bring one wire back of the other and over to form a loop (Fig. 2). Hold the wire in place with the thumb of one hand. With the other hand bring the second wire down over the crossed portion of the first and pull this second wire from the back up through the loop formed by the first wire (Fig. 3). Pull the ends of the two wires to tighten the knot (Fig. 4).

It is well to practise these steps with a waste piece of lamp cord.

When the knot is omitted in wiring a socket, plug, or fixture of any kind, there is nothing to prevent the strain from coming directly on the connections. Even if the wires are not pulled out entirely, they often become so loose under the binding screws that the lamp fails to light or lights intermittently.

This is the first of a series of articles on electric wiring by Mr. Willoughby.



ONE SUN that has never set!

By Irvin S. Cobb

OVER at the factory they told me that the sales of Sweet Caporal Cigarettes had been mounting up steadily here of late. There was no unusual stimulation in the way of a special advertising campaign. But sales had grown larger and still larger. They are growing while you are reading this. More Sweet Caporals are being sold today than were sold yesterday, more will be sold tomorrow than were sold today.

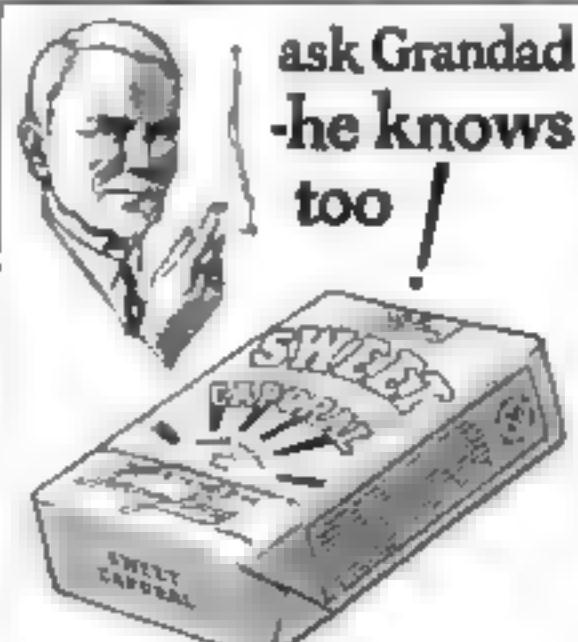
This condition applies to the re-



tailers all over the United States. According to expert opinion there can be but one explanation to account for so spontaneous and unforced a groundswell in the demand for a brand which has been a standard and a staple for forty-seven years.

The answer is that an increasing number of cigarette smokers in America are turning to the crusty natural blend that suited their fathers and their grandfathers who bought Sweet Caporal Cigarettes before them, a blend of selected Virginia tobacco, made into cigarettes by a process which has never been changed, with the purest of Vermont maple sugar for its savoring, and positively nothing else.

Perhaps you have noticed that part of



ask Grandad
-he knows
too!

The best smokes be ever had were
"Sweet Caps"
Suggested by
The American Tobacco Co.

the trademark of Sweet Caporals is a blazing sun. That trademark is historic. It appeared on the first package of Sweet Caporals that was manufactured back in 1878. No matter whether you buy the package of 12 Sweet Caporals for ten cents, or the package of 20



Sweet Caporals for fifteen cents, you'll find that same ancient and honorable device upon it. Here is one sun that has never set or sunk in forty-seven years and is rising higher now than it ever rose before. You can't get away from an argument that speaks for itself.

Sweet Caporal, to my way of thinking, is that kind of cigarette. It speaks for itself. And it's speaking louder all the time.

Thank you.

Irvin S. Cobb

P. S. — I write an article like this every once in a while. Watch for the next. I have declined propositions to turn out advertisements for various manufactured articles because I feel I merely would be a hired hand, exploiting this, that or the other thing for so much a word. But I reached for this opportunity. I know I could put my heart in it—could with sincerity endorse the article I was penning.

"There's One You Won't Break"

THE STAR SPECIAL FLEXIBLE BLADE



This Hack Saw Blade will eliminate the great waste through breakage.

Practically unbreakable, both as to blade and teeth and is recommended for the toughest work.

"Star" blades have gained a prestige and reputation through their record of performance.

Let us send you samples of the blade Free.

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Makers Since 1883.



STAR HACK SAW BLADES

CLEMSON BROS., INC.

MIDDLETOWN, N. Y.

The Home Workshop

Homemade Play Car Has a Curious Bucking Motion

By JOHN SWINLAND

MY BOY Horace had broken his auto. His ever-recurring importunities to "make something out of it" suggested to me one day that, indeed, some kind of vehicle could be constructed from the wreckage. From then on for a few weeks most of my spare time was spent in the basement of my home in Duluth, and the evening's work often became so absorbing that it carried me far into the night.

Our first contraption was on the jack-knifing principle and resembled in a way the one shown here, but it had no reach or gears. By the use of pawls or dogs on the wheels to prevent backward motion, we succeeded in making the thing go ahead, but only like a "grasshopper," the front and rear parts moving alternately.

For outside use Horace and his sister, Maurine, wanted more speed and a steady motion. It took much time and hard study to figure out how to make this animal buck and still go forward steadily, but I finally succeeded in devising the car illustrated.

The car, operated by a lever *A* in the hands of the rider, has a forward motion and a peculiar rising and falling, or horse-back action, that delights the child and is interesting and fascinating to the spectator.

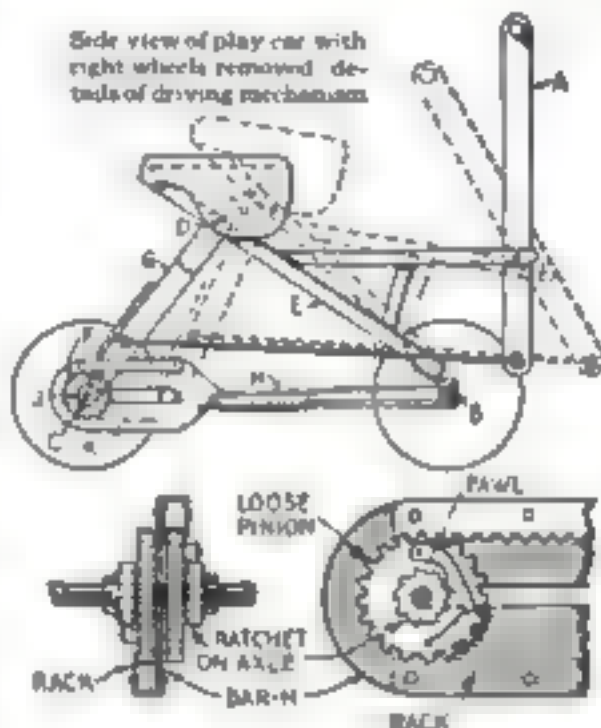
The main frame members (*E* and *G*) are hinged at the front and rear to the axles (*B* and *C*), as well as just under the seat at *D*. A slotted steel bar, *H*, serves to tie the axles together, and, as will be explained, provides the forward motion.

Referring to the diagram, it will be seen that pulling on the lever *A* will draw the rear frame *G*, the rear axle, and the wheels toward the front axle, thereby causing the other parts to assume the positions shown by the dotted lines. This action revolves the left-hand pinion, for

it is in mesh with the rack *K* riveted to the bar *H* on the lower left hand side. Through the medium of a pawl and a ratchet on the same side, the axle is turned, propelling the whole vehicle forward about seven feet.



Side view of play car with right wheels removed; details of driving mechanism.



While this is taking place, the pinion on the right-hand side of the bar *H* has been revolving backward, being in mesh with the rack above it, and since it is fitted with a ratchet and pawl like the first pinion, it turns freely on the axle. But as soon as the pressure is released from the lever *A*, the weight of the rider tends to make the rear axle move backward in relation to the front axle, which brings into engagement the pinion and pawl on the right-hand side, causing another forward impulse to the car, while the left-hand pinion turns freely backward on the axle.

Thus one pull of the operating lever and its return to the starting point sends the car forward nearly 15 feet and humps the "animal" in a manner that is certain to captivate any child.

The front axle is pivoted in the center and has foot rests to provide for steering. A spring holds the front wheels to a straight course. While coasting the lever is stationary.

A LENGTH of discarded bicycle chain or any other chain that has flat axle links, will provide a supply of neat repair plates for mending furniture, toys, and other articles. The plate may be let in flush with the surface of the wood easily by boring two holes and chiseling out the space between.



This unique vehicle opens and closes, and humps the rider up and down as it speeds forward.

To Help You Get Better Radio Reception

A New Radio Club to Study the Weather

YOU are invited to join a newly organized club to study the relations between radio reception and the weather. There are no dues and no assessments. This new organization is the Storm-O-Guide Club. All readers of POPULAR SCIENCE MONTHLY are eligible.

A thousand charter members in all parts of the country are wanted to help in a nation-wide semi-scientific study to determine the effect of weather conditions on radio reception.

It is hoped that through thousands of individual observations, the study of these individual observations when assembled at Club Headquarters and the free exchange of ideas among its members, the underlying causes for atmospheric interference with good reception will be discovered.

Everybody interested in radio will find the study of weather a fascinating hobby—a hobby that will undoubtedly lead to better all-round radio reception as well as being a material aid in getting greater distance.

Preliminary observations have indicated that when radio signals cross regions of different atmospheric pressure DX reception is better than when the signals parallel pressure lines. Whether or not more extensive and thorough investigation will prove the correctness of this preliminary observation is one of the scores of questions that can be settled only by the active intelligent co-operation of radio fans throughout the country.

STORM-O-GUIDE CLUB

BELOW you will find an Application for Membership in the Storm-O-Guide Club. If you wish to be a Charter Member of this new club fill in and mail the application blank today. Remember there are no dues and no assessments. Joining the club puts you under absolutely no obligations. The Storm-O-Guide Club is purely a co-operative organization for promoting better radio reception. You are invited to

Join To-day!

Application for Membership in the STORM-O-GUIDE Club

Secretary, Storm-O-Guide Club,
Radio Instrument Companies,
125 Ames St., Rochester, N. Y.

PLEASE enter my name as a Charter Member in the Storm-O-Guide Club. I have filled in a blank for information asked in this application as made in the conference of the fact that there were no dues or assessments and that I am placed under absolutely no obligations.

Signed

Address

Name of Set

Country

NAME
ADDRESS

Every Handy Man needs

SMOOTH-ON NO. 1

SMOOTH-ON

No. 1 hardens like iron and expands in doing so to make cracked, open or loose parts everlastingly tight.



Don't pay any professional fixer a big price to make such repairs. With Smooth-On No. 1, you yourself can do a perfect job for a few cents and usually in a few minutes.

Get the Smooth-On habit and you will quickly find that it keeps many dollars in your own pocket. Try it on the following and see for yourself.

IN THE HOME

Stopping leaks in steam, water, gas, oil or stove pipes, mending cracks, breaks or leaks in furnaces and boilers, radiators, tanks, sinks, pots and pails, making loose handles tight on umbrellas, knives, hammers, brushes, drawers, etc., tightening loose screws, hooks, locks, door knobs, etc.

ON THE AUTOMOBILE

Making bursted water jackets and pumps good as new, stopping leaks in radiator, hose connections, gas tank and gas, oil and exhaust lines, making a fume-proof joint between exhaust pipe and tonneau heater, tightening loose headlight posts, keeping grease cups, hub caps and nuts from loosening and falling off, etc.

To get perfect results, write to us for and use the Smooth-On Repair Book. Free if you return the coupon.

Get Smooth-On No. 1 in 7 oz., 1-lb. or 5-lb. tins at any hardware store or if necessary direct from us.

Smooth-On Mfg. Co.
Dept. 38, 574 Communipaw Ave.
JERSEY CITY, N. J.



Write for
FREE BOOK



Do it with SMOOTH-ON

A Ship Model of Your Own

carriages so that they help stiffen the bulwarks. Glue the under side of the guns, poke the muzzles through the ports, raising the latter slightly above the horizontal. Then glue the two guns on the forecabin, so that the muzzles point over the rail. These had better have been painted first—the guns gold and the carriages black.

Now put the masts in place and set up the rigging. For this I used two parts of crochet silk twisted together. Tie the middle of a length to the top of each mast; bring the ends down over the bulwarks to one of the holes previously bored. Glue the end of a toothpick and use it to push the thread in the hole; tap home with a light hammer and break off when dry.

Lash the yards with the sails on them to the masts about 1 1/4 in. from the top. You will now have to make 12 little blocks or pulleys (P) from wood or sections of a cellulose knitting needle. They should not be more than 3/8 in. long.

The running gear that holds the sails in position is clearly shown on page 80. The yards should point slightly across the vessel.

Glue the ends of the oars and put them in position with the blades skying very slightly up to the front, so that if they caught the water they would lift.

The awning over the poop can be of any beautiful material that is handy. In the present model it is blue with a design that resembles silver embroidery, and it is edged with a scarlet cord. It is a little more than 1 in. wider than the poop deck and 1/4 in. longer, to allow it to hang down at the sides.

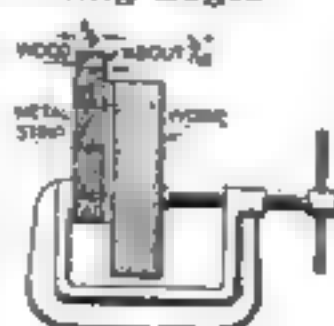
In front the awning is stitched to three long belt pins, which are driven into the main deck. The pins may be long enough to carry flags atop. Two shorter pins support the awning halfway along, and two more, right astern. If a thread is fastened to the front center pole and to the flag-staff it will help support the awning.

Put the lanterns in position and hang the anchor over the bulwark just abaft the fore rigging and your model is ready to start out on its mantle-shelf voyage of endless romance and adventure.

Alrikoom Salaam!
(Peace be with you.)

Gage for Planing Edges

PLANING long edges perfectly straight with a small plane, such as a common block plane, may be made easier for the beginner in woodwork by the use of a gage or templet. A wood or metal straightedge 1/4 or 3/8 in. thick is screwed to the face of a strip of wood so as to form a shoulder. This guides the bottom of the small plane without damaging the cutting iron.—HENRY JEVET.



AMPLION

Product of
38 Years'
Experience



"Brings in instruments lost in other speakers"

"I have listened to many loud speakers, but never to any music which can compare with that reproduced by the Amplion. The sound is clear, sweet and well modulated. It brings in clearly instruments in bands and orchestras that were lost in other speakers. Through my Amplion I enjoy my radio to a degree I had never thought possible."

You will be as appreciative as this gentleman, once you hear your set through an Amplion. Creation of the originator and oldest makers of loud speaking devices—Alfred Graham & Co., London, England—The Amplion leads in popularity throughout the world.

Enjoy an Amplion demonstration at your dealer's. Six models, including phonograph units, equipped with cords and panel plugs, \$12 up. Write for the "Amplion Pedigree."

THE AMPLION CORPORATION OF AMERICA

Suite H 120 Madison Ave., New York City
Chicago Branch: 27-29 N. Morgan St.
Branches of Canada, Ltd. Toronto

Prices Reduced
On All Standard Make
TYPEWRITERS

Lowest Prices in Years
We will ship any make you choose for one week's trial. Underwood, Royal, L. E. Smith, Remington, Oliver, etc.

Easy Terms
Less than rent each month and own a typewriter guaranteed as good as new. Shipped straight by express—the famous "Young's" offer and low price list only. WRITE TODAY!

Young Typewriter Co.
World's Largest Dealers in Standard Typewriters
654 W. Randolph St., Dept. 223, Chicago, Ill.

SMOOTH-ON MFG. CO., Dept. 38,
574 Communipaw Ave., Jersey City, N. J.
Please send the free Smooth-On Repair Book.

Name

P. M.

Return this coupon for a
FREE copy of Booklet

"Storm the Castle" Is an Easily Made Game for Children

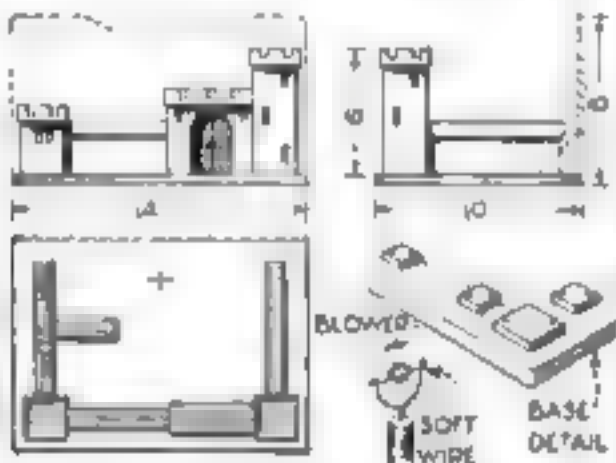


VISIONS of knights in armor and many the old story book tales are inspired up by this new battle game, "Storming the Castle."

It is played on a table with ammunition shot from pea blowers. Each blower is set up in the center of a castle made as illustrated. Ten men, which are really 1-in. lengths of $\frac{1}{4}$ -in. wooden dowels, are set up on the castle battlements. The ammunition consists of 12 wooden pellets $\frac{1}{2}$ in. long and of a diameter to fit the blower tubes freely.

The towers, which are constructed of cigar-box wood in separate units, have no bottoms, but are set over blocks on the base, as detailed. A cardboard backstop is provided to prevent loss of ammunition.

A good color scheme is to paint the base dark gray, the walls and towers light



Front, side, and plan views of the castle and details of the base and pea-blower holder

brown, the trim and gates dark brown, and the backstop light blue.

The blower itself is mounted so that it can be turned in any direction upon a dowel stick. To load, tip the mouthpiece downward and slide a pellet into the front end.

The game consists of three innings of four pellets each, and the winner is the one who knocks over the larger number of "men." DONALD W. CLARK.

Combined Gas and Coal Stove

TO FASTEN a gas plate to an ordinary coal range, obtain two lengths of $\frac{1}{4}$ -in. pipe or $\frac{3}{8}$ -in. rods 2 ft. long, two $\frac{3}{4}$ -in. pipe straps, and eight 1-in.-long stove bolts. Remove the extension shelf on the range, take the legs off the gas plate, and attach the gas plate with pipe straps where the shelf has been removed. Then flatten and drill the ends of the $\frac{1}{4}$ -in. pipe or rods so that they can be used as brackets extending from the front leg holes in gas plate to the side of the range well above the floor. DR. H. J. BLANK.



We win 80 out of every 100 men to this unique creation

Say the Word

and we'll send you a 10-day tube of this unique shaving cream to try

(NOTE COUPON BELOW)

GENTLEMEN

The way we win new customers to Palmolive Shaving Cream is by giving men a 10-day tube to try.

In less than 5 years we've gained high place in that way.

95% of the men answering our ads are wedded to other makes of shaving preparations. Yet we win 80 out of every 100 to this unique creation.

It's different from any other shaving cream known. 60 years of soap study stand behind it. We tried out 130 different formulas in perfecting it.

It embodies the four great essentials 1000 men told us they wanted in a shaving cream, plus a fifth—strong bubbles—that we ourselves found and added.

To add the fifth touch to shaving beauty, we have added Palmolive After Shave Talc, especially for men. This is a new, clean, cooling, softening and soothing skin cream. It is a unique creation, and it is the only one of its kind. It is the only one of its kind. It is the only one of its kind. It is the only one of its kind.

5 Important Features

You'll find it superior in at least five major ways:

- 1—Multiplies itself in lather 250 times.
- 2—Softens the beard in one minute.
- 3—Maintains its creamy fullness for 10 minutes on the face.
- 4—Strong bubbles hold the hair erect for cutting.
- 5—Fine after effects due to palm and olive oil content.

Find Out

What we tell you is based on what we as expert soapmakers know. Our toilet soap, Palmolive, is the leading toilet soap of the world.

Now in courtesy to us, will you accept a test of our shaving cream, give us the opportunity to prove the claims millions make for it?



10 SHAVES FREE

and a can of Palmolive After Shave Talc

Simply insert your name and address and mail to Dept. B-114, The Palmolive Company, (D.J.) Corp., 3702 L. St., Chicago, Ill. 3 modern ways of shaving should address The Palmolive Company, (D.J.) Corp., Milwaukee, Wis.



 This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

The Home Workshop

How to Hang a Door

(Continued from page 116)

light pencil line across one side of the stile. Now hold the lock against the stile so that the spindle hole is on the line and the front plate is flush with the stile edge. Mark the position of the keyhole and knob with an awl (Fig. 5). Slip the front flange over the door edge in order to locate the ends of the mortise for the lock.

If the escutcheon plates act as key plates and knob roses, bore keyhole and knob spindle hole with a $\frac{3}{8}$ -in. bit, cutting in from one side until the spur pricks through the opposite, and finishing from that side. If individual roses and key escutcheons are used, bore the spindle hole with a $\frac{3}{8}$ -in. bit and the keyhole with a $\frac{1}{2}$ -in. bit, cutting out the straight lower part of the latter with a $\frac{3}{4}$ -in. chisel.

Gage a center line for the mortise, and with a $\frac{3}{4}$ -in. bit bore five holes centering on the line. The end holes also are centered on the end lines. Use a wide chisel to trim out the mortise until the lock slips in freely. Insert the lock, slip in the spindle, and put in the front plate screws. Then use the plate as a templet for marking the boundary of what is to be its own shallow mortise (Fig. 6). Remove lock and chisel out the wood until the plate will fit in flush (Fig. 7). Bore the lock in and put on the escutcheons or the knob spindle roses and keyhole plates.

CLOSE the door until the bolts touch the jambs and mark top and bottom of each with a pencil. Open the door, gage a pencil line as far back from the edge of the jamb as the inside edge of the lock front, and screw the keeper in place, observing the bolt marks on the jamb. Trace around with a knife, remove and dap in flush. Bore out the mortises for the bolts last of all.

This method varies somewhat from the usual practice of carpenters, but the home mechanic will find it well adapted to his particular needs.

Before painting or varnishing, remove the lock and keeper.

In many cases the lock, as it comes from the hardware store, has the beveled face of the catch bolt facing the wrong way. Lay the lock on a bench and take out the plate screws. Lift the side plate off carefully to avoid loosening the parts, then take out the latch bolt (Fig. 4), turn it over, and replace the cover.

The concluding article in the attic room series will appear next month. It will pay you to preserve the entire series, which began in September, 1925, for the wealth of woodworking information it contains.

Lining a Stove Firebox

AS A lining for fireboxes in stoves, I have found three parts of common dry clay thoroughly pulverized and mixed with one part of Portland cement to be excellent. The powder should be made into a thick paste by adding water. F.W.W.

YOU don't need "B" Batteries if you use the FRESHMAN MASTER "B" Battery Eliminator

FOR
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Overhauling a Rear Axle

(Continued from page 110)

rough streets sets up vibrations that ordinarily serve to loosen a frozen hub.

Recently a friend called me to say that he had broken a couple of good wheel pullers without freeing his wheels. After driving around the block once with the nuts loose, he had one wheel loose, but it required four circuits of the block to release the other.

Figure 3 shows the process of disassembling the axle. After the housings are separated and removed, the differential is disassembled. To remove the side gears, if it is necessary to replace the axle shafts, they first are driven toward the outer end of the shaft a bit and the spool ring removed, after which they may be driven off toward the inner end. In garage practice a forcing press is used for this work; but if care is used the home mechanic can do it with a hammer and wooden blocks or by using a short piece of pipe for a drift.

A pin is used to hold the universal to the front end of the propeller shaft.



Fig. 3. After the axle has been disassembled, inspect each part for defects.

Insert this pin with the holes in the housing and use a drift punch to remove it.

Inspect all parts for wear or failure. The bearings supporting the outer ends of the rear axles carry a great load. When they are run without proper lubrication they will cut into the axle shafts. Worn shafts are subject to breakage and they create friction, which consumes power. The bearings are ground out and grease escapes into the brake drum, which may put the hand brake out of commission. In such a case it is useless to replace the felt grease retainers, since the axle flops about in the bearings and pounds the felt out of shape, splashing the grease past it.

Another point where failure may occur is in the case of the ring and pinion gears. A small piece of steel from a broken gear tooth may lodge between two teeth of the ring gear and pass under the teeth of the pinion until they are badly clipped.

When replacing gears, make very certain they fit properly and are locked securely in position. The ring gear must lay in close contact with the differential carrier and the cap screws must have the heads carefully wired. The pinion shaft must be drawn into the taper of the propeller shaft to a snug seat, with key in place, and then be locked securely with the cotter key.

(Continued on page 120)



"Sorry —my dances are all taken"

NOT a dance with her! It spoiled his entire evening. Other men had dances with her, but he had none. It seemed odd that he was always "just too late." Or — was that her way of deliberately refusing to dance with him?

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Two types, one the R-311 is invaluable for increasing the grid to plate capacity with 100 and 100 tubes and is extensively used for equalizing radio frequency circuits. The other the R-312 is ideal for equalizing the capacity of imperfectly matched intermediate transformers and for single dial control. Adjustment is permanent and easily made.

R-311 Max. Capacity 5 Micro. Microfarads . . . \$1.00

R-312 Max. Capacity 40 Micro. Microfarads . . . 1.50

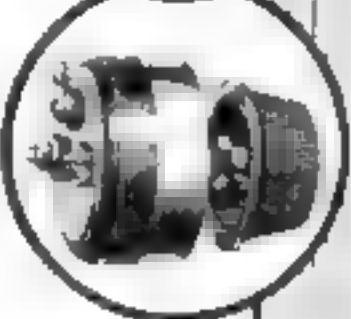
See your dealer or write for full description

The Sterling Mfg. Company

Cleveland, Ohio, Dept. V.

Sterling

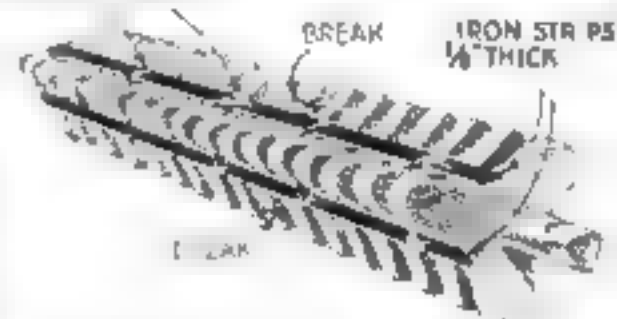
RADIO PARTS



How to Repair Broken Furnace Grates in an Emergency

IN AN emergency a broken furnace grate often can be repaired by wiring three iron strips along the depressions as shown. The strips should be not less than $\frac{1}{4}$ by 1 in. in cross section and as

BINDING WIRES



The cracked grate is held together temporarily with three iron bars bound on with heavy wire

long as the grate. The wire should be $\frac{1}{2}$ in. in diameter or a little larger.

On one occasion I made use of this method in repairing a grate that remained in service for a surprising length of time and more recently I repaired another furnace in the same way. The need for some such method is due to delay often entailed in obtaining new grates from the manufacturer especially if a furnace is of an old and perhaps discontinued model — F. W. WILDER.

Overhauling a Rear Axle

(Continued from page 112)

When assembling the differential carrier and axle shaft in the axle housing, it is necessary to use special care. The ring gear is to the left of the pinion gear rather than to the right. In other words, it is toward the left side of the car or in the end of the left housing.

Strange as it may seem, it is not at all unusual to find rear axles assembled and rebuilt so that when the car is placed in low gear it travels backward, in reverse it travels forward, and in high it travels backward. Cars with two speeds in reverse are one of the garageman's standard jokes, yet the thing continues to happen.

Always use new thrust washers against the ends of the differential carrier in re-assembling a Ford axle. Make certain that the steel washers remain in position on the little dowel pins that keep them from turning. Cup grease on these parts will help the assembly.

New brake shoes in the wheel brake drums are always to be recommended if the car has seen considerable service. New bearings frequently are required and new gaskets always used.

When installing the job under the car, make certain of every point requiring any fastener such as pin, bolt, or nut. Where cotter pins are required, always insert them. Turn the hub locking nuts on the axle shaft up tight. Fill the housing with clean, fresh transmission or differential lubricant to the level of the filler plug. Drive the car a day or two and then retighten the nuts.

It also is well to go over all nuts and bolts after a few days and reset them. When carefully rebuilt in this way, the job ought to be good for a long period.

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How to Lay Roll Roofing

BECAUSE of its cheapness and apparent ease of application, composition or "paper" roofing sold in rolls is used frequently by home owners, especially for porch roofs, garages, outbuildings and repair work of various kinds, and sometimes on the main house roof. Yet this type of roofing often is laid in such a way as to make it valueless in a few years.

It never should be placed over sheathing boards that are separated more than $\frac{1}{4}$ in. at the joints. The sheathing should be thoroughly seasoned so that it will remain firm and level at all times. All knot holes should be covered with pieces of tin or the knots nailed down tightly.

At the eaves a piece of iron bent as shown on the next page should be nailed to form a drip edge and to keep the roofing



Can prevent roofing from being pulled up from edge down

in a firm position. This does away with the ragged, unsightly edge usually seen on paper roofs. Cement the roofing to the metal drip edge and then nail it along a line about $1\frac{1}{2}$ in. from the edge.

Roll roofing, wherever practical, should be laid the long way of the building instead of from ridge to eaves. A convenient method of laying it is to start at the top or ridge and lay down ward toward the eaves. This is by far the best method, in my opinion, but seldom is used.

Nail cleats along the roof every 4 ft. from the eaves to within 8 ft. of the ridge. Measure the ridge and if the building is more than 30 ft. long, cut the roofing in several strips not more than 30 ft. each. If these strips are laid out flat in the sunlight for a time, they can be handled much easier on the roof.

Take enough strips to go the entire length of the ridge and lay them one at a time with about 4 in. lapping over the ridge. Reach over, fold this 4-in. overlap, and, starting in the middle of each sheet on the outside of the lapover, nail at 2-in. intervals. By nailing from the middle, all buckles are removed.

When the sheet is fast the entire length

(Continued on page 122)

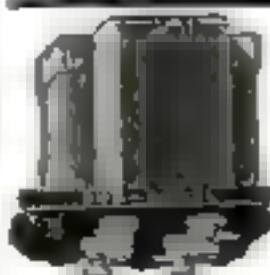
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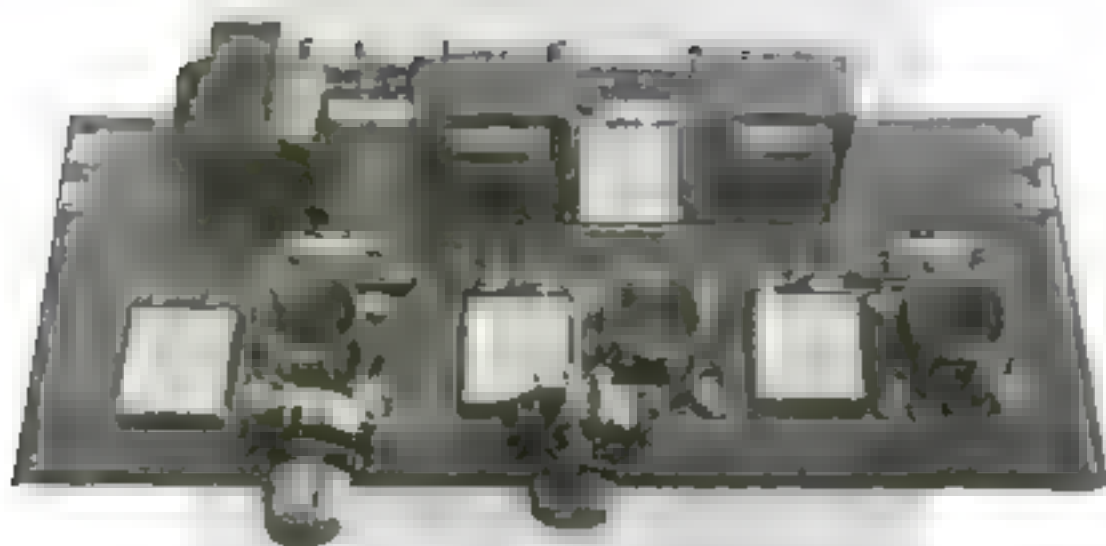


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In impedance coupled Amplifiers (which evenly amplify all the notes in the musical scale) as well as in most of the latest developments in audio amplification, fixed condensers and grid leaks are essential elements of the hook up.

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The set-builder who uses *Dubilier By Pass Condensers* and the silent *Dubilier Metaleak* in constructing this unit, works with the assurance that comes from the use of parts whose performance has been tested and guaranteed by the best known manufacturer of condensers in the world.

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Slit Sheet Home

(Continued from page 121)

on the lapover, remove the first row of cleats at the top and lay the second row of paper in the following manner. First scribe on the roof boards with a pencil or a piece of chalk a line where the bottom of the top row of paper is to come. Measure up 8 in. from this and make a few marks as guides. Now throw the top layer of paper back, slide the next sheet to the marks and fasten it with a nail or two at the middle. Let the top sheet drop

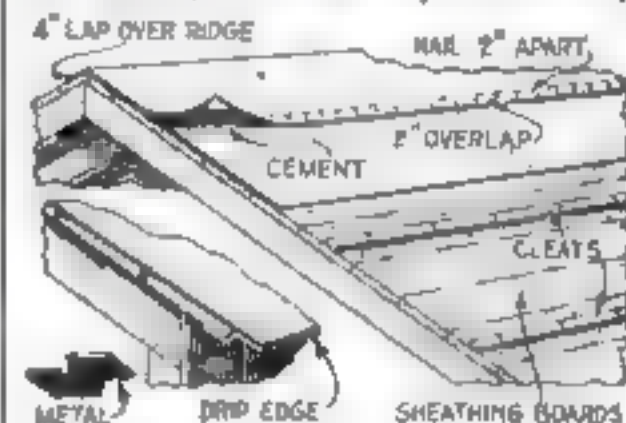


Diagram showing the principles of laying roll roofing and how to finish the lower edges

down, mark along its lower edge, raise it again and repeat carefully to this line. Then nail along the joint, starting as before from the middle. Lay all the sheets down to the eaves the same way.

You will find that the finished roof is without a hackle and that the seams are invisible from the ground. Furthermore, not a smear of cement will show and that is of great value on the mineral-surfaced colored roofings used on dwellings. There will be no holes in the roof from walking or dragging material over it.

Chick-stick or pine furring strips 1 by 2 in. are ideal for use as cleats on all but the steepest roofs. **CHARLES W. HUBERT.**

Reinforcing Furnace Joints

SOME so-called perfect or one-piece furnaces give more or less trou-

ble after they have been used for a while because the cement that holds the sections together becomes loose and permits ashes, gas, and smoke to come up through the register into the living rooms. Often much damage is done in this way to draperies, furniture, and wallpaper.

This objection was overcome to a great extent in my own case by having four angle irons made at the local blacksmith shop. The irons were made to fit as nearly as possible the conformation of the top and bottom sections of the furnace, as indicated in the accompanying drawing.

Two long rods were threaded at each end like bolts. These were slipped through the holes in the free ends of the two pairs of angle irons, which were approximately alike. After the furnace joints had been well puttied with furnace



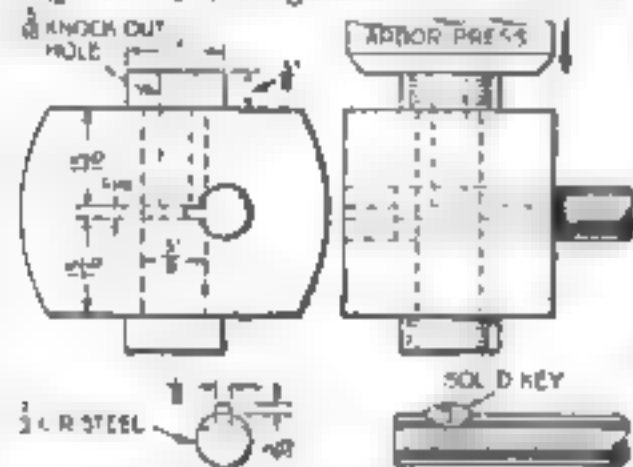
How to prevent gas leaks from a furnace

Better Shop Methods

Swaging a Solid Key on Cold Rolled Steel Shafts

A NOVEL method of swaging a key on a small shaft is illustrated below. This idea is suitable for certain classes of work in which the key is not required to have great strength, as in the mechanism of typewriters, adding machines, and other office appliances.

The tool steel die block has one hole to fit the shaft and another hole at right angles to the first for the punches. A keyway is cut through the work hole the



After the shaft has been inserted in the die block, two punches are used to form a solid key

same size as the key to be formed on the shaft. The top punch is pierced with a $\frac{3}{16}$ -in. hole, which is useful if it becomes necessary to knock out the bottom punch.

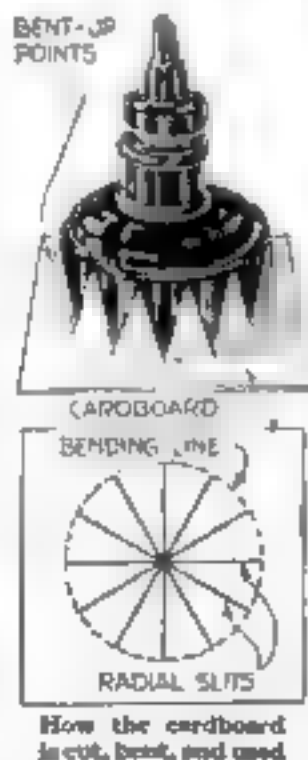
The work is placed in position in the die block, both punches are inserted, and pressure is applied by means of an arbor press. If the punches are made so carefully that the shoulder distances are exactly right for the thickness of the key, the work will not vary more than .001 in. in thickness. If a larger key is required, the shaft can be slid along in the hole and another key swaged in line with the first.

Cardboard Stand Prevents Ink Bottle from Tipping

ONLY a piece of cardboard 10 or 12 in. square and a rubber band are needed to make a safety stand for the draftsman's ink bottle.

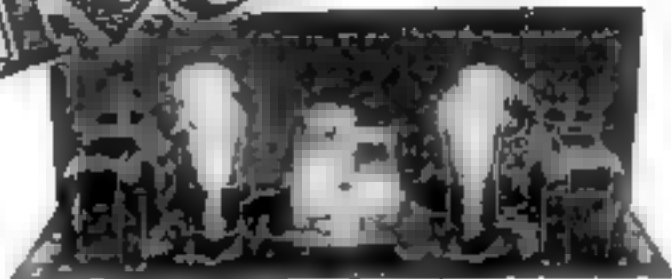
Lay out a circle in the center of the cardboard the same diameter as the ink bottle. Then cut 10 equally spaced radial slots and bend the points upward. Press the board down over the bottle so that it rests firmly on the table, as shown at the right, and then snap a rubber band around the bottle near the bottom.

The bottle may be moved around without danger of its being tipped and the surface of the cardboard makes a convenient resting place for drafting tools.—H. L. W.



Send for this New Hookup Silver Cockaday

Four Tube Receiver



Here is a new radio receiver sensation in which are combined the genius of McMurdo Silver and Laurence M. Cockaday. A receiver for the home builder that will represent for several seasons to come a far greater dollar for dollar value than any other design available.

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WIRING AND ASSEMBLY—All wiring is carried in special harness. Since each wire is exactly the right length, and has a special color, it is impossible to go wrong in wiring.

Over-all design, rugged and solid. Adapted to practically any standard cabinet, any standard tube, any battery or eliminator source of supply, instant attention or repair. Full description of the receiver will be published in the March issue of Popular Radio.

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AGENTS

Write to the nearest agent and territory representative.

Nestler Process is simple to itself as demonstrated by the inventor, Emil Nestler, rubber expert and engineer. One step of 7 which comprise process here shown.



New Tires from Old

Amazing New Patented Process Fuses or Welds New, Tough, Durable Rubber Tread onto Worn Tires

CONCEIVE that of all methods present or past the Nestler Rubber Fusing Process alone produces a positive joint such as by fusing or welding between new and old rubber! The first and only practical and successful method of re-rubbing a tread worn tire is here at last—a simple, fast, inexpensive process that makes tires new again and cuts tire costs in half.

Think of the opportunity for this service right in your community! Right now the opportunity is exceptional on account of present tire costs. And all indications point to still higher prices for years to come due to an impending rubber famine. The result is a tremendously increased demand for Nestler Service.

Each year since 1917 thousands of worn tires have been successfully re-rubbed by ourselves and those licensed by us under the basic Nestler Patent. We are now prepared to issue to men who qualify, a limited number of additional licenses. License rights will include protected territories and full cooperation from this company. Previous experience is unnecessary since licensees will receive thorough training without charge. We have demonstrated that any person of average intelligence can learn to operate the Nestler Process and the simplified Nestler Equipment in a few weeks' time. Investment for necessary Equipment only from about \$1000 upward, depending on production required for territory. Terms may be arranged.

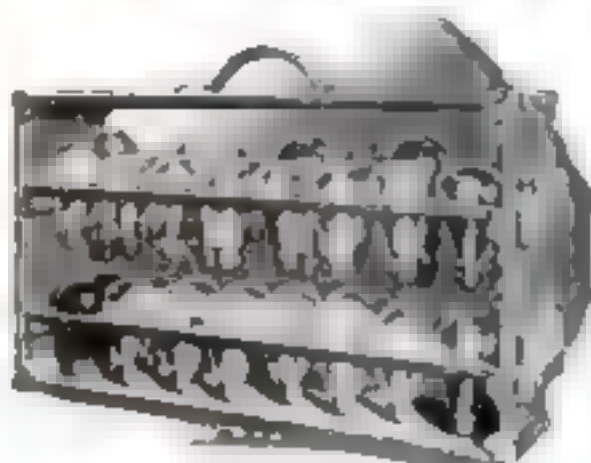
The 34 million tires worn out annually, constitute a limitless opportunity for business and profit. With aggressiveness and the application of sound business methods, a Nestler Rubber Fusing Station yielding \$10,000, to \$20,000, or more yearly profits can easily be created.

The Nestler Plan tells how it can be done. It gives facts and figures in addition to a full description of the Nestler Rubber Fusing Process, Nestler Equipment and the way they work together. Chance territories are now going fast. If the bare outline of this proposition as given above is interesting to you, you are urged to write without delay.

Nestler Rubber Fusing Co., Inc.
Dept. SP—245 W. 55th Street
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Better Shop Methods

Lamp and Fuse Carrier for Shops and Large Buildings



FOR large buildings the lamp and fuse carrier illustrated saves time for whoever is charged with the task of keeping the electric lights in order. The actual cost of making it was \$1.10, and that was for the box corners and leather handle. The wood came from a packing case.

It was designed and made to aid in the work of replacing lamps in a hospital where the buildings are scattered over extensive grounds. Carrying the various sized lamps around in their original packing had been a nuisance and often resulted in breakage.—JAMES F. MAGER.

General Utility Shop Clamps Made Quickly by Welding

THE new style of clamp illustrated is welded from pieces of scrap boiler tubing. It is strong enough to stand any strains to which it may be put.

In making it, a 1-in.-wide ring is cut from 2 in. boiler tubing and is flattened on the sides to an oval shape. A reinforcement made from a section of a similar ring is fitted snugly around one end of the oval, and the ends of this are oxyacetylene welded to the sides of the oval-shaped section.

A 1/4-in. hole is drilled through the top of this reinforced section and top of ring, then tapped for a set screw.

The shoe of the clamp is another piece of 1-in.-wide ring cut from boiler tubing, bent to fit, if necessary. A spot is countersunk in the top of the shoe to receive the point of the set screw.—A. G. WICKOFF.



This powerful clamp serves many purposes.

Selecting Babbitt Metal

BABBITT metal in the better grades is composed of tin, antimony, and copper in about the proportion of 88, 10, and 2 respectively with no lead. The cheap grades contain only a small percentage of tin and antimony and rarely any copper; indeed the bulk of the poorer varieties is chiefly lead. To insure reliability and endurance in a bearing, only the highest grade babbitt should be used. It costs more, but wears longer.



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There's a joyousness—a sense of absolute freedom about canoeing that comes with no other sport. "What shall we do this summer?" is uppermost in the minds of thousands. Why not let an "Old Town Canoe" help answer the question for you?

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Better Shop Methods

Drilling in the Lathe without Using a Centering Tool

SO SIMPLE a thing as drilling a hole in a piece of work held in a lathe chuck may be made even easier if the method illustrated is used. It is not even necessary to use a centering tool.

The drill is held in the tailstock spindle and advanced so that it almost touches the work. A tool of any kind is put in the toolpost with the point elevated somewhat so that a flat surface is pre-



The drill, after being steadied with a lathe tool, centers itself

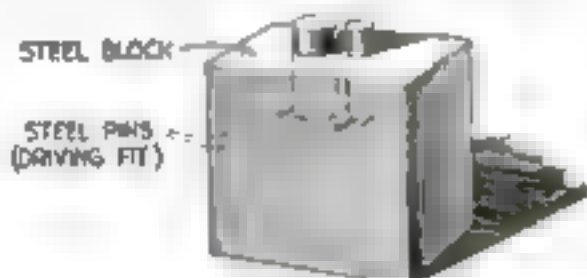
sented to the drill. The tool is run in until it touches the drill, which is slowly fed into the work.

If the drill wobbles, the tool is pushed a little harder against the drill, which soon centers itself. One caution has to be borne in mind. The drill must be cutting freely and without wobble before the tip is below the surface.

I have used this method for years and have never seen it fail. It requires little practice, and when mastered saves time.

When a taper shank drill is used in conjunction with a drill holder, I start the drill with a heavy center punch mark near the center and proceed to true up the drill in the same way.—W. H.

Forming Small Eyes by Hand



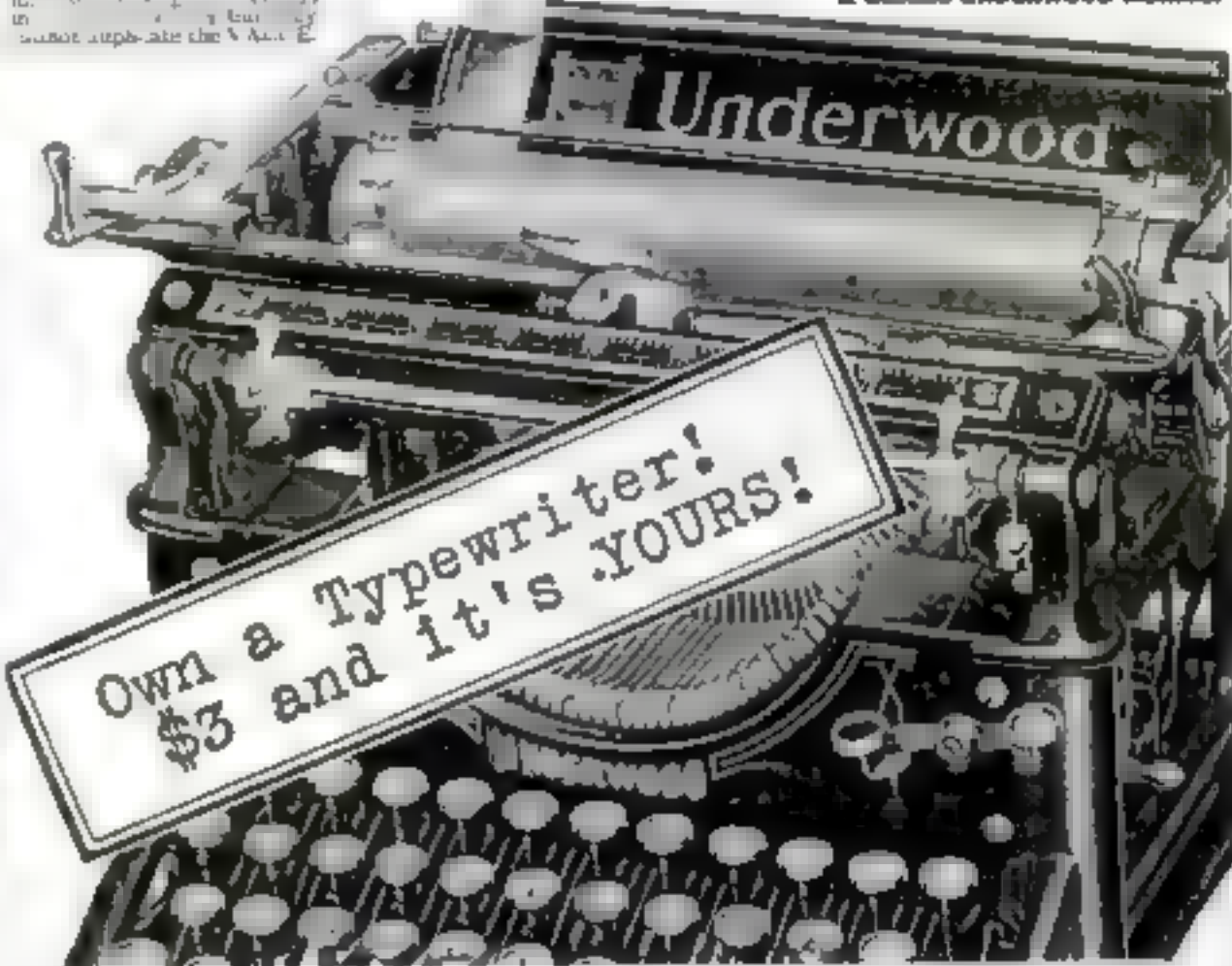
THE necessity for forming an eye on a number of rods so that the centers of the eye and rod would be in line led to the development of the device illustrated.

Two holes were drilled in a small block of steel, these were a driving fit for steel pins, one the size of the required eye, the other a little larger. The distance between was the thickness of the wire stock.

An eye was formed and centered by placing the stock in the first position and turning to the second, third, and fourth positions shown. The former was found to work equally well on round or flat stock, but when the flat stock is used, the pins must be as high as the stock is wide.—HAROLD N. WHITMORE, M. E.

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Better Shop Methods

Old Bill Talks on Cutting Fluids

(Continued from page 125)

soda improve the mixture and prevent the rusting of the machines and work. Water alone will perform the function of cooling, but it has the objection of causing rust on machine parts. The addition of soda overcomes this.

For grinding operations plain soda water is used a great deal, but it does not produce as good a finish as some of the specially compounded solutions for this work.

On punch-press work many kinds of lubricants are used. In some cases the metal to be worked is smeared with a pasty lubricant such as white lead and oil, talcum and graphite, or soft soap thinned with paraffin oil.

For metal drawing special drawing oils are used. They often are mixed with white lead or graphite. The lubricant sometimes is applied directly to the metal, but whenever practicable it should be applied to the ram, as there is always more or less accumulation of lubricant on the outside of the dies.

BORAX is claimed by some authorities to be superior to soda for mixing with compound cutting solutions. When using either of these the amount should be just sufficient to mix well with the water and oil. Too much soda or borax will cause the several ingredients to separate and necessitate frequent agitation of the liquid.

While borax water and soda water work well on grinding operations, for other kinds of metal working such as turning, milling, and drilling, the tools do not stand up as well as when oils or oil compounds are used.

A common fault of plain soda water or borax water is that it works under the slides and other working surfaces of the machines and cuts away the lubricating oils. This is another reason why oils generally are preferred. A watery solution also has to be changed more frequently than oil.

The question as to whether a cutting liquid is a lubricant or a coolant or both the author leaves open for debate. On some work it appears to be only a lubricant, as with thread cutting and metal drawing. On other work like turning, milling, and drilling, its function takes more the form of cooling. As only metal cutting edge is in contact with and actually buried in the metal there would seem to be little chance for lubrication; the tool does not slide over the work with a film of oil between.

We associate lubrication with two or more sliding surfaces between which there is a film of oil and theoretically the two surfaces do not actually touch each other, but are kept apart by oil. This condition does not or cannot exist between a tool and the metal it is cutting and the term "cutting lubricant" seems meaningless. But, after all, the value is not in the name; it is in the thing. So I shall leave the reader to judge for himself whether a liquid cools or lubricates or does both.

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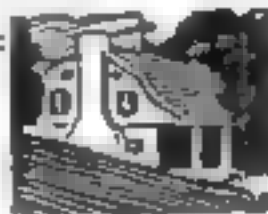
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Better Shop Methods

Adjustable Stand for Holding Shop Magnifying Glass

IN THE tool room a large magnifying glass has many uses and even for laying out ordinary work at the bench it is to be preferred to a smaller magnifier. The only drawback is the possibility that the expensive glass may be broken through careless handling. This difficulty can be met, however, by providing a stand for the glass as illustrated.

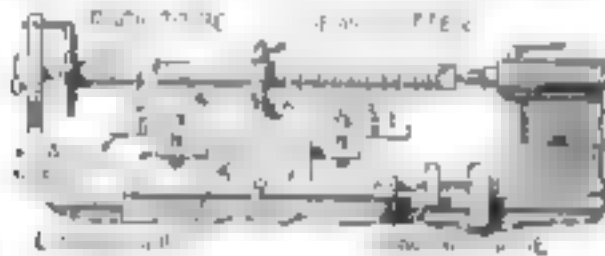


A large magnifier mounted for shop use

A stand of this type has stood for several years on one toolmaker's bench, and surprisingly many uses are found for the glass in the course of a day's work. H. L.

How to Set Up a Lathe for Cutting Racks Accurately

WHEN a shop is not equipped with a miling machine suitable for cutting racks, it is possible to set up a lathe as illustrated for doing the work. The rack is screwed to a piece of flat steel,



Work is mounted on cross slide and cutter is held on a long arbor between centers

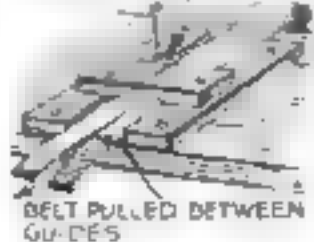
which is packed up to the height that will make it possible to cut the teeth the proper depth. The cutter is held on a long arbor. Spacing is done by means of a gage the length of the pitch. The gage is used between a clamp on the bed of the lathe and a pin set in the end of the carriage. The cross feed is operated as on a miling machine. CHARLES K. COLE.

A Novel Slitter for Belts

SLITTING a piece of belting into two or more pieces can be done quickly and accurately with the aid of the simple guide illustrated. All that is needed are three pieces of wood $\frac{1}{2}$ by 2 by 10 or 12 in., a dozen nails and a sharp pocket knife.

Nail the pieces together and insert the knife into a slot in the upper one. Lay off and slit the belt by hand for about 6 in. from one end and place it in the guide. Pass the knife blade through the slit and tap it lightly into the bench about $\frac{1}{4}$ in. Then pull through the entire belt. If necessary, nail a piece of wood across the back end to hold the belt down in the guide. EDWIN G. BAKER.

STATIONARY KNIFE BLADE



BELT PULLED BETWEEN GUIDES

Cutting the leather

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Better Engineering Methods

High Speed Steel Inserts for Lathe Tail Centers

TURNING pieces of small diameter, especially if they are of alloyed steels, trouble oftentimes is experienced, where high speed is required to obtain a good finish, from the burning or galling of tail centers. An inexpensive method is illustrated that will overcome this trouble in most cases.

HIGH SPEED STEEL INSERT



TAIL CENTER

This center is not apt to burn or become galled.

overcome this trouble in most cases.

A small high-speed steel center is inserted into a corresponding taper in the lathe center, with a cross or drift hole to facilitate easy and quick replacement.

The high speed inserts should be hardened carefully, then drawn back at about 1000°F. They should be ground carefully to fit the tail center so that they will be interchangeable.

It will be found also that the high speed steel will stand more abuse from lack of lubrication and too much tension on the centers without picking up. B. H. S.

Finishing Surfaces of Thin Machine Parts

THIN work often cannot be clamped hard enough in a vise to hold it for finishing its surfaces without bending or springing it. In such cases good results may be obtained by clamping a wooden block in the vise and mounting the work upon it with several wire brads, as shown.

The heads of the nails are filed off flush with the surface of the work to allow the part to be removed and replaced easily. The hole in the block is for the reception of a rod to eject the work if it can not be removed readily with the fingers.



The work is held on a wooden block by brads.

While this method is adapted particularly for filing and polishing surfaces, it may be employed for light machining, such as drilling or milling small slots. In the latter case, however, clamps of some sort are required.

For this purpose several screws with large heads overlapping the work will serve. A portion of the screw heads may be filed off for convenience in placing and removing the work.—S. W. Brown

The practice of resharpening files is seldom, if ever, economical. Some of the larger may be recut by factories making a specialty of such work, but resharpened or recut files do not give as satisfactory service as new files.

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Letters that Won Prizes in the January Contest

(Continued from page 125F)

For her letter about the Crown Fuel Saver Company and how they opened the door of opportunity for her father, Miss Grace M. Baker of Washington, D. C., won the Third Prize.

Contest Editor

My 1925 subscription to "POPULAR SCIENCE" was a Christmas Gift from my father, which in reality was a wonderful gift to himself.

One of the most promising Opportunities Ads that my father answered was that of the Crown Fuel Saver Co. of Richmond, Indiana. Being granted this territory for the sale of Crown Fuel Savers, he at once developed a remarkable business.

Father accepted your guarantee of Advertisers in "POPULAR SCIENCE MONTHLY" at 100%. He found this Company composed of Real Red-Blooded Christian Men, who help a man to succeed if he has the willingness, pluck and perseverance.

Also, having bought various articles under your (U. S.) Guarantee, I find "POPULAR SCIENCE MONTHLY" indispensable from every standpoint. To Crown it all, "Money Making Opportunities" is a "Wireless Message" where all who read can tune in and win.

Sincerely yours,

GRACE M. BAKER.

The money to be made as a finger print expert is illustrated in the following letter from G. Rose of the Police Department of Huntington West Virginia who tells how he found his road to success through the advertising of the University of Applied Science.

Contest Editor

You look at it, I looked at it, tell everybody to look at it, it is on page No. 165.

It put My Wife, My Self and Seven Kiddles in a Home Of Our Own, it put Me in this Office, a good steady position at a very satisfactory salary, write Mr. Lawrence Sanders of the First National Bank, Pittsburgh, Pa. It put the parties in the Penitentiary that attempted to rob his Bank, and in return put Me the proud possessor of that Ten Thousand Dollar Reward offered by his Bank, and it put Me in a position to do this without leaving this office. It, Dear Editor, is the interesting Ad of the University of Applied Science, 1920 Sunnyside Avenue, Chicago, Ill. Finger Prints; they are everywhere, more of them than anything else.

Sincerely,

G. ROSE.

Charles L. Nelson of Academy, South Dakota, devotes most of his letter to the advantages to be found in the Money Making Opportunities Section. But in one paragraph he concentrates on the wonderful success brought to him from a law course he took from the La Salle Extension University.

Contest Editor

The most valuable advertisement in your January issue is your own, pages 126-130.

(Continued on page 125H)



We Mail Your Copy of This Book-FREE

Remarkable new book on Salesmanship just off the press will be mailed to you without cost or obligation

The contents of this amazing new book—just published by the National Salesmen's Training Association—will prove a revelation to every man who is interested in making real money, and to those who realize the tremendous possibilities for high earnings in the selling field.

Thirty thousand copies of this book will be mailed free without cost or obligation to those who send for it while the supply lasts.

FULLY EXPLAINS NATIONAL DEMONSTRATION METHOD

Thousands have wondered why N. S. T. A. Men were so successful in their work, and how they did it. Now they know, for the first time, through this book. It explains the National Demonstration Method, the only system of selling that has ever been developed. It shows you how to get your feet on the ground, how to get your feet on the ground, how to get your feet on the ground. It shows you how to get your feet on the ground, how to get your feet on the ground, how to get your feet on the ground.

QUICK SUCCESS THROUGH N. S. T. A. TRAINING

Whether you have had selling experience or not, it makes no difference. The N. S. T. A. System of selling is a simple, easy, and profitable method of selling. It shows you how to get your feet on the ground, how to get your feet on the ground, how to get your feet on the ground. It shows you how to get your feet on the ground, how to get your feet on the ground, how to get your feet on the ground.

Since by this Training takes you through every phase of a successful selling campaign, you can be sure of success. It shows you how to get your feet on the ground, how to get your feet on the ground, how to get your feet on the ground. It shows you how to get your feet on the ground, how to get your feet on the ground, how to get your feet on the ground.

TYPICAL EXAMPLES OF SUCCESS

When A. H. Wagoner joined the N. S. T. A. he was making \$3.00 a week. He enrolled with the N. S. T. A. and, after a few days, he was making \$24.00 a week. He enrolled with the N. S. T. A. and, after a few days, he was making \$24.00 a week. He enrolled with the N. S. T. A. and, after a few days, he was making \$24.00 a week.

EMPLOYERS

are invited to write to the Employment Dept. of the N. S. T. A. No charge for this service to you or our members. Employers are also cordially invited to request details about the N. S. T. A. Group Plan of Instruction for entire sales forces. Synopsis and charts sent without obligation.

BIG DEMAND FOR TRAINED SALESMEN

Big and growing sales positions are open in every line of business. The N. S. T. A. has thousands of trained salesmen who are ready to take the place of the untrained men who are now doing the work. They are trained in the N. S. T. A. system of selling, and they are ready to take the place of the untrained men who are now doing the work.

JUST MAIL THE COUPON THE BOOK IS FREE

To fill in and mail, the coupon will not obligate you in any way, but it will show us a real salesman. It will pay you to fill it out, and it will pay you to mail the coupon and get it into the mail.

**NATIONAL SALESMEN'S
TRAINING ASSOCIATION**
Dept. C-15, N. S. T. A. Bldg., Chicago, Illinois

National Salesmen's Training Ass'n,
Dept. C-15, N. S. T. A. Bldg., Chicago, Ill.
We have no cost or obligation on your part for this book. "Modern Salesmanship" is a free book of training and employment service.

Name _____
Address _____
City _____ State _____
Age _____

Building Draftsmen WANTED



\$6,000 in Four Months

IN 4 MONTHS
you can learn to
draw and design
buildings and
earn \$6,000 a year
as a draftsman.

\$210 Per Month

you can earn \$210
a month while
learning to draw
and design buildings
and earn \$6,000 a year
as a draftsman.

\$6,000,000,000 in Building

Train at Home for Big Money in This Fertile Field

Six Billion Dollars in one year! Think of it! Today Building is probably America's greatest and most profitable industry. Here is a field

whose future is insured by the normal growth in population and the industrial expansion of our country. There is a big building shortage now and many competent observers predict that our largest cities will be practically rebuilt in the next ten years due to ever higher standards of living. Six Billion Dollars spent each year in building means fortunes for thousands who have the vision to grasp the opportunity open now to get in on the ground floor.

Get Into Big Pay This Easy Way

Architectural or Building Draftsmen are needed everywhere. Get out of the low or moderate pay job. Step into a *real* job. You can do it with training in Architectural Drafting. Salaries are big because of the tremendous demand and the shortage of trained Building Draftsmen. Work is steady and you have a splendid chance to go into business for yourself. This

is the opportunity offered to you by this old established school of Architecture and Building Construction. Step out of the \$40 a week class. Learn how to earn \$50 to \$100 a week and later \$5,000 to \$10,000 a year as chief or superintendent.

Train at Home—Earn as You Learn

No need to quit your present job. Keep your present income and prepare for a bigger one. Our simple "Practice Plan Method" will qualify you quickly in your spare time. Into it has gone over 25 years of experience and the best knowledge of our large staff of architects and builders. It is simple, complete, resultful. Practical, successful builders guide you. Lessons in plain English. A common schooling in all you need. Get the facts now—today.

FREE TRIAL LESSON AND BLUE PRINTS

Just to show you how easy it is to learn Architectural Drafting by our method, we will send you a Trial Lesson and Blue Prints Free. Test yourself and see how you like the work. Send no money—just the coupon. Get this Free Lesson now with our Big Book of Opportunity also free. Make your first step today—it costs you nothing.

MAIL COUPON TODAY

Chicago Tech. College, Dept. 231, Chicago Tech. Bldg., 116 East 16th St., Chicago, Ill.
Send me, without obligation, your Free Trial Lesson, Blue Prints and Book of Opportunity. I want to know how to become a Building Draftsman. It is understood that no money will be asked.

NAME _____

ADDRESS _____

CITY OR TOWN _____

STATE _____

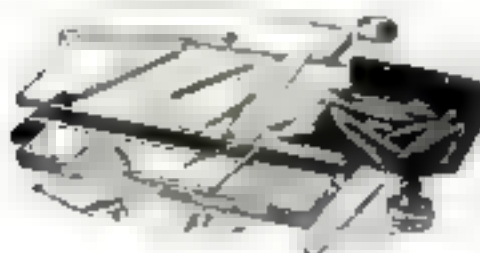
In Chicago Earn While You Learn



Chicago Tech. Building
Short Day or Evening Courses offered in Building Construction and Drafting in our Chicago School. Part time positions defray living expenses. 72 page "Blue Book" tells all. Ask for it if interested in coming to Chicago to attend the College.

This \$25.00 Drawing Outfit

Same without extra cost. Good for a lifetime. Mail the coupon and learn how to secure this valuable outfit.



CHICAGO TECHNICAL COLLEGE

Dept. 231 Chicago Technical Bldg.
116 E. 16th St. Chicago, Ill.

Letters that Won Prizes in the January Contest

(Continued from page 128G)

This because it promotes a wider reading of the advertisements, the greatest opportunity of today, voices the purpose and multiplies enormously the value of this magazine in promoting ambition, progress, achievement and opportunity.

The advertisements hold a key to opportunity, information, knowledge that leads to more knowledge, power, money, a life career—opportunity unparalleled—unequaled in any age.

A dozen men nationally known, a score of leading business executives, another score, incomes in five figures and over half as many more with private businesses worth upwards of a million dollars each, hundreds, thousands of lesser achievement, owe their successes in great measure to the reading of an advertisement.

To me it gave a law course (La Salle,) two farms, information, knowledge, a business, business training worth thousands of dollars, independence for life.

CHAR. L. NELSON.

These letters illustrate graphically the success that can be yours if you take advantage of the offers advertised in the Money Making Opportunities Section.

Start on the road to success to-day. Study all the advertisements shown on pages 128F to 158. Select those that offer you the opportunity you are most interested in and fill in the coupons or write for further information.

Complete List of PRIZE WINNERS

In the January Contest

FIRST PRIZE \$50

John F. Hardecker, Brooklawn, N. J.
(American School of Aviation)

SECOND PRIZE \$25

William Gray, Youngstown, Ohio
(International Correspondence Schools)

THIRD PRIZE, \$10

Grace M. Baker, Washington, D. C.
(Crown Fuel Saver Co.)

PRIZE WINNERS who receive \$1.00 each for their letters

G. Rose, Huntington, West Va.
(University of Applied Science)
Chas. L. Nelson, Academy, S. D.
(La Salle Extension University)
Eric C. Webb, Denver, Colo.
(Mac-O-Cheer Milk)
D. J. Denning, Lynn Haven, Fla.
(University of Applied Science)
O. F. Biermann, Pasadena, Hawaii
(University of Chicago)
Bredner Martin, San Luis Obispo, Cal.
David B. Clarkson Co.
Rev. L. V. Bennett, Cook, Minn.
(Washington School of Cartooning)
Edward O'Brien, Williamsport, Pa.
(International Correspondence Schools)
L. B. Pearson, Coalwood, W. Va.
(American School of Aviation)
M. D. Martin, Oglesby, Texas
(National Radio Institute)
Rev. Alan Premley Wilson, Baltimore, Md.
(U. S. School of Music)
Leslie J. Miller, Rock Springs, Wyo.
(Northwestern School of Tailoring)
Lloyd H. Bell, Washington, Penna.
(Producers League)
Margaret Hamner, Fayette City, Pa.
(Sherwin Cody School of English)
Leonard L. Shum, Lathrup, Mich.

Electrical Experts are in Big Demand!



It's a shame for you to earn \$15 or \$20 or \$30 a week, when in the same six days thousands of men as Electrical Experts are making \$70 to \$200—and do it easier—not work half so hard. Why then remain in the small-pay game, in a line of work that offers no chance, no big promotion, no big income? Put yourself for a real job in the great electrical industry. I'll show you how.

Be an Electrical Expert

Learn to Earn \$3,500 to \$10,000 a Year

Today even the ordinary Electrician—the "screw driver" kind—is making money—big money. But it's the trained man—the man who knows the whys and wherefores of Electricity—the Electrical Expert—who is picked out to "boss" the ordinary Electricians—to boss the big jobs—the jobs that pay \$3,500 to \$10,000 a year. Get in line for one of these "Big Jobs." Start by enrolling now for my easily learned, quickly grasped, right-up-to-the-minute, Spare-Time Home-Study Course in Practical Electricity.

Age or Lack of Experience No Drawback

You don't have to be a College Man; you don't have to be a High School Graduate. As Chief Engineer of the Chicago Engineering Works, I know exactly the kind of training you need, and I will give you that training. My Course in Electricity is simple, thorough and complete and offers every man, regardless of age, education or previous experience, the chance to become, in a short time, an "Electrical Expert," able to make from \$70 to \$200 a week.

Your Satisfaction Guaranteed

So sure am I that you can learn Electricity—so sure am I that after studying with me, you, too, can get into the "big money" class in electrical work, that I will guarantee under bond to return every single penny paid me in tuition. If, when you have finished my Course, you are not satisfied it is the best investment you ever made. And back of me in my guarantee, stands the Chicago Engineering Works, Inc., a two million dollar institution, thus assuring to every student enrolled, not only a wonderful training in Electricity, but an unsurpassed Student Service as well.

Free Book on Electricity

I want to send you my Electrical Book and Proof Lessons, both Free. These cost you nothing and you'll enjoy them. Make the start today for a bright future in Electricity. Send in Coupon—Now!

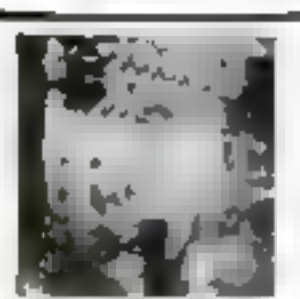
L. L. COOKE,
Chief Engineer

Chicago Engineering Works
2156 Lawrence Ave.,
Dept. 33 Chicago

Get Started Now!
Mail Coupon

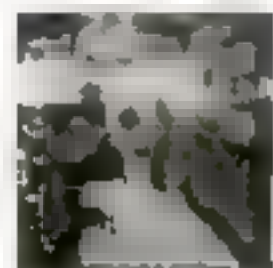


With me, you do practical work—at home. You start right in after your first few lessons to work at your profession in the regular way and make extra money in your spare time. For this you need tools, and I give them to you—5 big complete working outfits, with tools, measuring instruments, and a real electric motor—5 outfits in all.



**Pay Raised
150%**

"I was a doubter in electricity until I got in touch with you Mr. Cooke. But now I have charge of a big plant, handling 400 motors and direct a force of 25 men. My salary has gone up more than 50%."
GEORGE L. LINGWORTH,
30 Columbia Street
Chicago, Ill.



\$700 in 24 Days

"Thanks to your interesting course I made over \$700 in 24 days by Radio. Of course this is a little above the average but I run from \$20 to \$40 clear profit every day on five sets per week your training has done for me."
FRED C. McHARR
1 W. 34th St. Atlanta, Ga.



\$20 a Day
—for Schooling

"Use my name as a reference and depend on me as a teacher. The biggest thing I ever did was power over all variations. I am working better than ever and making more money than ever."
JOHN H. HARRIS
Phoenix, Arizona



L. L. COOKE,
Dept. 33
2156 Lawrence Ave., Chicago

The Man Who Makes "Big Pay" Men

Send me at once without obligation your big illustrated book and complete details of your Spare-Time Study course in Electricity including page outfit and employment service offers.

The Cooke Trained Man is the "Big Pay" Man!

3 Electrical Lessons

actually
FREE!

to prove you can
learn at home
in spare
time



Get ready-Quick! for a big-pay Job in ELECTRICITY

I have placed hundreds of men in fine Electrical jobs at salaries from \$60 to \$125 a week. Several hundred more needed. They need not be high school graduates (the grades will do) but they must be willing to devote part of their spare time to learning Electrical principles and practice by a new Job-method built by 23 leading Electrical Engineers, and simplified for home-study. Three Lessons sent you absolutely free to prove how interesting and easy and valuable this instruction has been made.

I WILL make this Contract with you:

A million dollar institution stands back of this agreement to PREPARE you to hit a well-paid Electrical job and then to help you FIND THE JOB or to refund the small amount charged for your training! Here is your opportunity to get out of the class of under-paid, money-worried men, always out of a job or afraid to lose one. To step into the rank of men who are paid BIG SALARIES for what they KNOW, instead of starvation wages for what they DO!

4 Costly Electrical Outfits Given!

I send you absolutely without extra cost, as a part of this training, 4 costly outfits of standard size tools and materials, so you learn Electricity by DOING actual Electrical jobs. One of these outfits is a \$10 Electric Motor—a real motor and generator, the same type

as the big fellows in a power plant. I send it to you "knock-down" and have you wind the field and armature and assemble it. That's the way I teach every branch of Electricity! House-wiring, Electric Light, Radio, and Motor outfits included.

Training Built by 23 Noted Engineers

This is the only institution in the world where 23 leading American Engineers have helped me build a wonderful home training method.

Westinghouse
Western Electric
American Tel. & Tel.
General Electric
Marconi
Columbia
and other leading corporations and universities.

Your name here *Wm. C. Campbell*
When you enroll for my home-training in **ELECTRICITY** I agree to give you:
1. Complete training, including Electrical Engineering, Ignition, Radio, etc.
2. Four outfits of standard tools and materials, including a \$10 motor.
3. I WILL HELP YOU GET A GOOD JOB AND A RAISE IN PAY.
4. —or I will refund every cent of your money.

AMERICAN SCHOOL
—the Million Dollar Educational Institution



AMERICAN SCHOOL
By Chief Engineer Dunlap

Get My Job Service Guarantee Offer

If you have reached the point where you realize YOU MUST train and specialize to get anywhere, write me immediately. I will show you the wonderful opportunities, the enormous salaries, the many openings waiting in this booming industry. I will tell you about the most sensational combination TRAINING-AND-JOB offer ever made, which is practically a guarantee of your success. Mail coupon and get 3 Free Electrical Lessons and complete information.

CHIEF ENGINEER DUNLAP
ELECTRICAL DIVISION

AMERICAN SCHOOL, Dept. Drexel Ave. and E375, 58th St., Chicago

3 Electrical Lessons Free!

CHIEF ENGINEER DUNLAP
ELECTRICAL DIVISION

American School, Dept. E375

Drexel Ave. and 58th St., Chicago

Send me your Job Service Guarantee offer, 3 Free Electrical Lessons, facts about the opportunities in Electricity, etc.

Name

Street No.

City

State

PROOF!

that we place men in
JOBS!



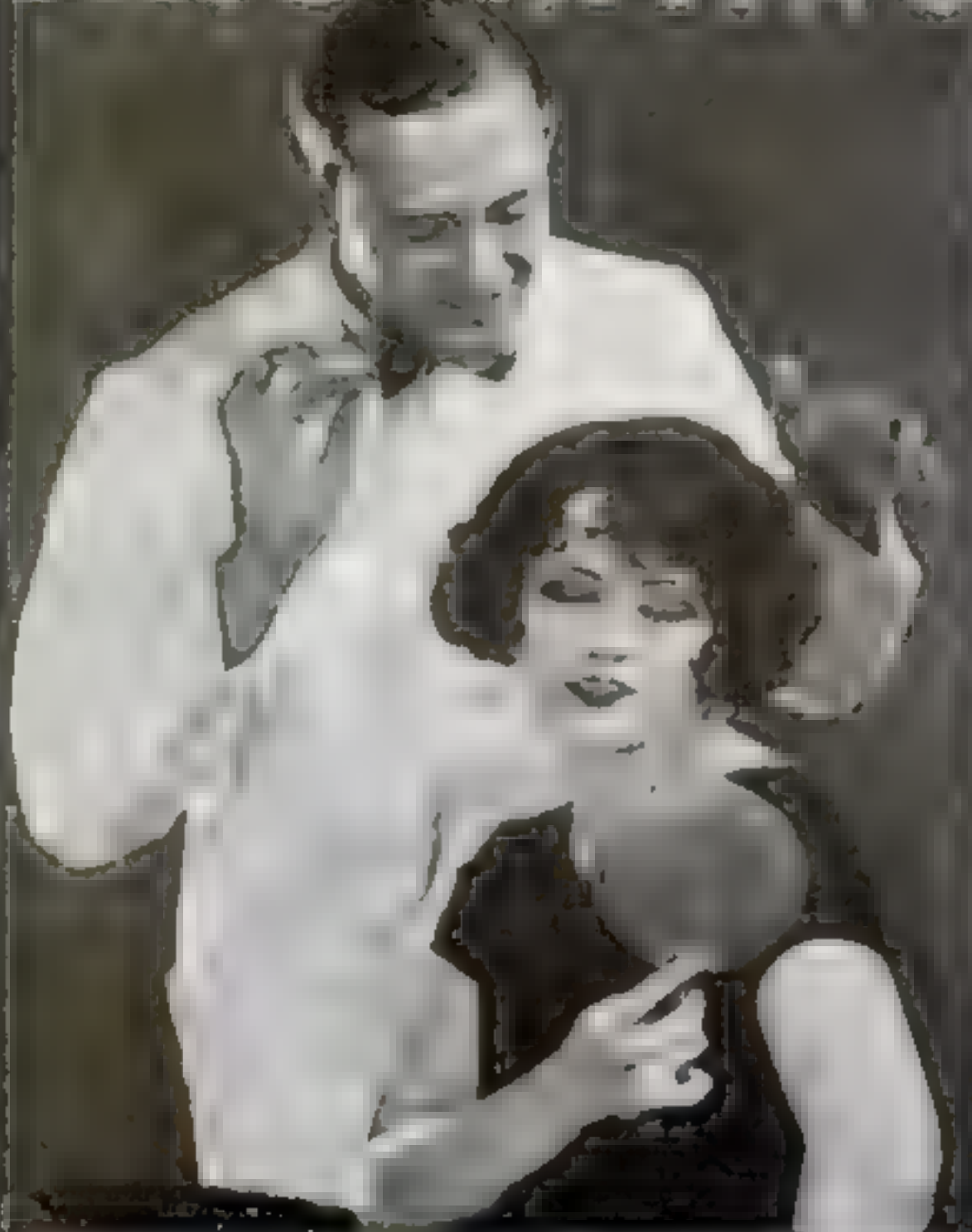
SAITENHILFENUSCHULSTISWUSSEN

[illegible]

Never before has the world seen anything like the head-on impact of 9-11. And this has created an enormous human need for help, especially for the thousands of people who are homeless and struggling to find work. We greatly feel sure that these two programs will be able to meet that need.

SALESMEN AND AGENTS WANTED[illegible]

FASCINATING



and perhaps you like other am-
bitious men who to the work of money
and are endeavoring necessary to make
difficult situations. I have written what
you can get at quickly and make the most
out of your money. I have not included the
best thing you are looking for. For there

Address the branch of the MOUTER SYSTEM OF COLLEGES nearest you
Street address not needed

Chicago, Ill.
New York, N. Y.
St. Louis, Mo.
Kansas City, Mo.
Cleveland, Ohio
Cincinnati, Ohio
Pittsburgh, Pa.

Detroit, Mich.
Denver, Colo.
New Orleans, La.
Indianapolis, Ind.
Minneapolis, Minn.
Atlantic City, N. J.

Memphis, Tenn.
Dallas, Tex.
Houston, Tex.
San Antonio, Tex.
Phoenix, Ariz.
Seattle, Wash.

Los Angeles, Calif.
San Francisco, Calif.
Portland, Ore.
Tacoma, Wash.
Portland, Me.
Washington, D. C.

is a profession begging for clean-cut, earnest
men like myself. Look into it. M. M. 123
3. After graduation from Modern Business
is easy to learn. It is a quiet life to
be a clerk and FASCINATING. It pays
better than any other. FIND OUT
What is it worth? E. J.

Grand Prize Awards Will Appear Next Month

IN NEXT month's issue will appear the names of winners of Grand Prizes in our great \$10,000 "What's Wrong" contest. The awards, totaling \$6,000, include a First Grand Prize of \$2,500; a Second Prize of \$1,000, a Third Prize of \$500, and 305 lesser prizes. Watch for the April issue, published March 16.

Food for Thought Necessary

FOR thought, you need food. This is indicated by an interesting series of experiments recently carried out by J. A. Glaze of the University of Chicago. He tested three persons, two men and one woman, who had gone from 10 to 30 days with no nourishment but water to find out whether or not they could do clearer thinking on an empty stomach.

In five tests out of seven, their mental efficiency, he found, decreased during the fast. After the fast was over, however, and food taken again, the subjects seemed to have greater mental activity.

During the first week of fasting, the subjects felt weak, but after that they regained strength.

Recent Publications

The Origin, Nature and Influence of Relativity, by George David Birkhoff. Six university lectures that give a clear basis for understanding a revolutionary theory. The Macmillan Company.

War Weather Lignettes, by Alexander McAdie. How weather influenced the world war—how blizzards and mists defied the finest of strategy. Illustrated. The Macmillan Company.

Surveying for Everyone, by A. Frazer Williams. How to measure and map land. Simple instructions for lay readers as well as students. The Sheldon Press.

Fundamental Concepts of Physics, by Paul B. Heyl, Ph.D. A discussion of the changing ideas of physics from the 18th century. Williams & Wilkins Company.

A History of Engineering, by A. P. M. Fleming and H. J. Brocklehurst. An illuminating story of the development of engineering through the ages. Illustrated. A. & C. Black, Ltd.

Aeronautical Meteorology, by Willis Ray Gregg. A handbook acquainting the reader with the behavior of the upper air. Contains detailed information needed by the aviator. The Ronald Press Company.

Science, Religion and Reality. Distinguished men of English universities throw new light on the question whether science is an enemy to religion. The Macmillan Company.

Outdoor Boy Craftsmen, by A. Neely Hall. Ideas for the boy who likes to make things. Lothrop, Lee & Shepard Co.



FREE 15 DAY TRIAL
Only 4 Methods used in playing this fascinating instrument. The native Hawaiian instructors teach you to master them quickly. Pictures show how everything is played correctly.

Play in Half Hour

After you get the four easy methods you play beautifully. No previous knowledge necessary.

Easy Lessons

Even if you don't know how to play, you can master the 15 printed lessons and the clear pictures make it play in half an hour. Pay as you play.

Free Catalog

and request to Catalogue Book Order. You'll never be disappointed with this beautiful Hawaiian Guitars. Write for Special Offer and they'll be yours. A postcard will do. A. L. T.

FIRST HAWAIIAN CONSERVATORY OF MUSIC, Inc.
8th Floor, Waldorf Hotel, Dept. 144, New York, N. Y.
Approved and Recommended by School Under the Laws of the State of New York

Write us Today

You'll never be disappointed with this beautiful Hawaiian Guitars. Write for Special Offer and they'll be yours. A postcard will do. A. L. T.

Stop Forgetting
Mentally Yours
After you get the four easy methods you play beautifully. No previous knowledge necessary.

"STAMMERING"
Its Cause and Cure
You can be quickly cured if you stammer. Send 10 cents and we'll send you 254 pages of the latest book on Stammering and Stuttering. It tells how I cured myself after 15 years and 14 attempts for 20 years.
BENJAMIN N. ROGUE
7527 Rogers Bldg., 1147 N. 1st St., Indianapolis, Ind.

What do You have to say when you are with interesting people?

Can you hold up your end in a general conversation—or are you tongue-tied when with people?

AFTER the weather has been discussed and exhausted it is only the well informed man—the good talker—who can hold the attention and interest of his friends.

Everybody envies a good talker. You know from experience the big advantage the man or woman has who is an easy, fluent talker. In every-day life men and women who have this personal advantage are popular—sought after. And in their trade, business or profession they are the ones that get to the top.

The valuable ability of being able to converse smoothly, naturally and with full confidence is based on having at your command a fund of knowledge that will be of interest to those you are talking to.



What Worth-While People Are Talking About

Today the most entertaining, the most fascinating subjects are those that deal with applied science—radio... aeronautics... the automobile; new discoveries in health... evolution... electricity.

These are the subjects that intelligent people are thinking and talking about. These are the things the worth-while men and women of your town or city are discussing.

To make it possible for you and the other thousands of men and women who feel the urge to keep up with the important things scientists have definitely established and the new discoveries that they are making we offer you **THE POCKET GUIDE TO SCIENCE** and 14 issues of **POPULAR SCIENCE MONTHLY**—all for less than 12 issues of **POPULAR SCIENCE MONTHLY** would cost you on the newsstand.

THE POCKET GUIDE TO SCIENCE is written in simple question-and-answer form that educators have found to be the most effective way for telling the known facts on a specific subject. In this one brilliant book of 284 pages

have been condensed all that you probably will ever want to know about science.

You are assured of the accuracy of the answers in **THE POCKET GUIDE TO SCIENCE**, as it was edited by Dr. E. E. Free, who has a remarkable genius for condensing the known facts about the world we live in into short, easily remembered paragraphs.

SPECIAL OFFER

THE POCKET GUIDE TO SCIENCE is not for sale. It is included, without any extra charge, with a 14 months' subscription to **POPULAR SCIENCE MONTHLY**.

POPULAR SCIENCE MONTHLY "carries on" from where **THE POCKET GUIDE TO SCIENCE** leaves off. **THE POCKET GUIDE** gives you all that the scientists have discovered up to right now—**POPULAR SCIENCE MONTHLY** will give you all the important, interesting and new discoveries of science for the next 14 months.

It takes over 300 articles and pictures every month to tell the readers of **POPULAR SCIENCE MONTHLY** all that has happened in the scientific, radio, mechanical and automotive fields.

Your Name in Gold on this Wonderful Book

THE POCKET GUIDE TO SCIENCE is bound in beautiful leather cloth and West. It is the only book of its kind in the world. It is the only book of its kind in the world. It is the only book of its kind in the world.

We extend to you the Special Offer of a 14 months' subscription to **POPULAR SCIENCE MONTHLY**.

POPULAR SCIENCE MONTHLY (regular price by the month would be \$2.50) with **THE POCKET GUIDE TO SCIENCE** is for \$2.95, plus the few cents postage.

If you are already a subscriber to **POPULAR SCIENCE MONTHLY**, we will extend your subscription 14 months if you accept this offer.

SEND NO MONEY

Send no money, just the coupon. If within 10 days after you receive the book and magazine you decide that you are not satisfied in every particular, you may return them, and your entire payment will be refunded promptly and without question. Could any offer be fairer?

Popular Science Monthly
250 Fourth Avenue, New York

I accept your offer of **THE POCKET GUIDE TO SCIENCE** and a 14 months' subscription to **POPULAR SCIENCE MONTHLY**. I will pay the postman \$2.95, plus the few cents postage when he delivers me **THE POCKET GUIDE** and the 6th issue of **POPULAR SCIENCE MONTHLY**.

If the book and magazine are not fully satisfactory to me, I will return them within 10 days and you are to promptly refund my full payment. Please stamp my name in gold on the **POCKET GUIDE TO SCIENCE**.

Name _____
Address _____
City _____ State _____



Mistakes I Made When I Built My House

(Continued from page 135)

We pay by the pound and receive by the earnt. It takes the bloom off the blithest exultation. When the house was being built, I could easily have incorporated an outside filler for the ice chest. It will be a tedious and expensive job to do that now.

MOST everybody fastens things to masonry walls with wooden plugs packed into drilled holes. I did that with some fruit shelves in our cold storage compartment. One night the dried-out plugs let go—it was during the war and we thought the enemy had dropped an air bomb on us—crashing 150 glass jars of tomatoes and fruit on the concrete floor. Not a jar survived, and the floor looked like a slaughterhouse. There was enough broken glass to rat-proof every chicken house in our community. After this event, I built new shelves of white pine boards supported by 1 1/4 by 3/4 inch steel straps, each bolted to the massive floor joists above; with 8 by 4 inch bolted crosspieces, and all shelving fastened to frames with long screws. As a test of strength, my neighbor helper and I lay at full length on the new shelves, and then we demonstrated rigidity by pulling and pushing the frame. Instead of wooden plugs in masonry walls (except for very unimportant jobs) use expansion bolts or pour lead or cement in place. For an extra heavy support, as needed by a steam radiator for example, I put long bolts completely through a masonry wall with washers and nuts duly attached.

The amateur builder is cheered when he finds that certain faults entail only a mild penalty or that makeshifts have served a fair purpose. Such was the case with my original plumbing system. It was sketchy, queer, but never disastrous. When the time came to have real plumbing the mechanic and I agreed to let the old waste line of cement pointed tile rest in peace beneath the cement floor of the basement. It had served. Why spend time and energy in ripping up a floor that was adamant? We just swung the new iron waste line overhead, attaching it at intervals to the floor beams. This open-work plumbing conforms to the latest ideals of the craft; it is always subject to inspection and correction, while the owner likes to take visitors downstairs and show them the cast iron inscription in bas relief, "Avg. wt. 12 lbs. per ft."

FRRIEND Wife was doubtless right as to closets. I won't start a debate on this subject, which is an eternal moot point between the sexes. Have to admit that we fixed up an extra curtain closet afterward. My advice to amateur builders is, let the wife draw the closets first, then build your house around them.

The dining alcove had barely been invented at the time when we built. Otherwise we might have one instead of a dining-room that is used once a day and is theoretically an expensive luxury because of overhead. Think how the space we squander on a dining-room could be used to enable the living-room, expand the



Aviation Brings Quick Success!

Sudden New Demand for Daring Young Men!

Aviation in America is on the threshold of an amazing new development. For in the past few months gigantic commercial air lines have been established. The biggest capital and business forces in the world are behind this enterprise. Even in the beginning, thousands of young men are needed. For those who can qualify there will be highly paid jobs which will lead quickly and surely to advancement and success.

Big Opportunities Await the Trained Man

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They Fly Their Own Planes

(Continued from page 140)

For instance, S. H. Curlee, president of a clothing company in St. Louis, decided a few months ago to establish a flying department in his organization. Roscoe Turner, a young commercial flier from Cornith, Miss., was placed in charge of experimental flying and is preparing to teach the company's salesmen how to pilot machines.

Another business executive who has found that flying pays is Ross W. Judson, president of Continental Motors. Only a few weeks ago he purchased one of the new Fokker three-engined, 10-passenger planes and announced that he and other executives of the company would use it on trips between the plants in Detroit and Muskegon, Mich. And everyone knows, of course, of Henry Ford's success in establishing a fleet of his planes in a passenger and freight transport system.

IN THE professional field we find such men as Dr. Herman J. Neumaner, a physician of Hickley, Ill. Not long ago he bought a two-seater biplane, hired a pilot, and now makes his rural calls by air.

Even the sportsman is taking to the air as Earl Sande, the great American jockey, will tell you. Not long ago, Sande climbed into the saddle of a Curtiss Oriole at Garden City and went for his first air ride. When he came down, he announced his intention of using an airplane instead of an automobile hereafter, to make his trips between racetracks in Maryland, Kentucky and New York.

James Olin, a wealthy importer and sportsman of San Francisco, owns half-a-dozen planes, employs expert pilots and takes his recreation on airplane hunting trips into northern California.

There is another side of the story, however—one not so encouraging to those of us who have dreamed of flying some day from our roof tops or back yards—as I soon learned when I visited the Curtiss Fleet, Long Island. There I talked with C. S. Jones, "Casey" as he is popularly known to fliers, general manager of the Curtiss Flying Service, Inc.

"I don't like to be discouraging," said he, "but it is my opinion that airplanes will not compete with the pleasure automobile. Rather, the airplane is the competitor of the railroad train and the motor truck. Unlike automobiles, airplanes are restricted by the necessity for flying-fields and well-equipped service stations.

AT THE present time practically all the planes we sell are purchased for commercial purposes, for passenger and express service, for air mail, and for aerial photography. Private individuals who purchase machines are in the main young men who come to our aviation school. Rather than hire machines, they buy their own 'Jeeps' for a thousand dollars or so and use them to learn how to fly. They keep them in our hangars, and usually they fly them here until the machines are worn out.

"Last year, about 50 of these boys bought their own planes. Some seek careers as commercial pilots, others just the sport of flying; others become Gypsy

(Continued on page 142)

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They Fly Their Own Planes

(Continued from page 141)

Fliers, wandering from place to place and making trips for hire, and still others learn to fly because they see a big future for aviation."

Yet, despite the limitations mentioned by "Casey" Jones, the day of a r motor-ing for every body may not be so far distant. For one thing, the number of convenient flying-fields is increasing so rapidly that it will not be more than a few years at the most before practically every city and town of importance will have its own airport.

THE other day, in the office of the Aeronautical Chamber of Commerce, I learned, for example, that questionnaires had been sent to some 400 American cities and towns asking them what they were doing in the way of developing public flying-fields and service stations for airplanes, and offering co-operation in such development. And in every reply that had been received, it was stated that a public landing field already had been established or was being planned.

The Ford Airport at Dearborn, Mich., and the recently established airport for both land and sea planes at East Boston, Mass., covering 852,000 square feet of land, are two outstanding examples. At the latter field, the Boston Airport Corporation right now is planning not only to provide cheap and safe aerial taxi service for the public, but also service and repair stations for individual owners of planes.

There is encouragement to be seen also in the new machines—planes that are being designed more and more to meet the needs of the average man.

In this connection a significant development in the light, economical baby-plane which can be housed in and flown from exceedingly limited space. In England, there have been produced nidget planes measuring only 10 feet across, capable of being housed in an ordinary automobile garage, and costing only about \$1,000.

But an even more significant promise of giving us our own planes to fly—at least it seemed so to me—was exhibited by "Casey" Jones, the skeptic. He led me across the Curtiss Field, unlocked the door of a large hangar, and showed me a corner of the big shed where rested a magnificent little three-seater—the "Lark," latest of Curtiss creations.

In appearance, this little ship looked much like any other plane. But in one great point it was different: it was built with interchangeable parts. In other words, its upper and lower wings on both sides were all exactly alike, the same in design and dimensions. Any one of the wings could be substituted in place of any other. The same was true of its ailerons and its elevators. The purpose was obvious—standardized quantity production, lower cost, cheaper maintenance.

It was Henry Ford who said at the conclusion of the successful Ford reliability tour last fall:

"We'll put all the people into the air whenever they want to fly. Aviation is bigger in possibilities than anything else in the world. In a motor car, you can go wherever land exists; in an airplane, you can go wherever man can breathe."



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Can a Bald Man Grow Hair?

(Continued from page 12)

would no sooner think of applying soap and water to their scalps than of bathing in concentrated sulphuric acid.

Let the prosecution against dandruff account, if it can, for the fact that dandruff affects the whole scalp but alopecia carefully selects its acreage. Furthermore, the bald spots are quite symmetrical in their distribution and growth, and it is a well established tenet in medicine that when the evidences of disease are evenly distributed on the two sides of the body the cause of the trouble is almost surely systemic rather than local.

THE latest theory of baldness, and the one which seems quite consistent with demonstrable facts, ought to spread joy among the countless thousands of bald-headed men. In brief, this view holds that baldness is a normal attribute of manhood. Women seldom become bald. Only masculine men are permitted to develop the alopecic insignia of their virility.

Popular imagination has long recognized the association of early baldness with a high degree of masculinity. Many of the satyrs pictured on the Greek vases were young and bald. The time-worn joke about reserving the first row at burlesque shows for bald-headed men is not without its element of truth.

The nature of the glands of internal secretion needs but little elucidation in these days of public enlightenment. In brief, an internal secretion is one that does not pass out from the gland through a duct but escapes from the secreting cells directly into the blood. Because of the fact that the secreted substance permeates every part of the body through the medium of the blood, it has been aptly termed a "chemical messenger."

SUCH a chemical messenger is responsible for the development of the general characters which mark the differences between the sexes. In the male, the internal secretion results in the male type of figure, in the low-pitched voice, in the growth of a beard, and in the acquisition of masculine aggressiveness. Briefly, the new theory of baldness holds that the condition of baldness is not a disease but a normal male characteristic.

The number of fake cures for baldness on the market exceeds the census of millionaires in Florida. Their continued existence is accounted for by the law of supply and demand. The stork supplies a new bald-headed sucker every five minutes and the manufacturer of the alleged hair fertilizer demands his dividends proportionately.

On the face of them, the claims made by the promoters of these nostrums are as incredible as a ten-dollar deed to the Grand Central Station. No thinking man would take the bait, but the trouble is that few men think, and those who do don't think all the time. When hope enters by the doorway, reason flies out through the window; and when hair is promised to a bald man, he buys first and thinks last, if ever.

(Continued on page 146)

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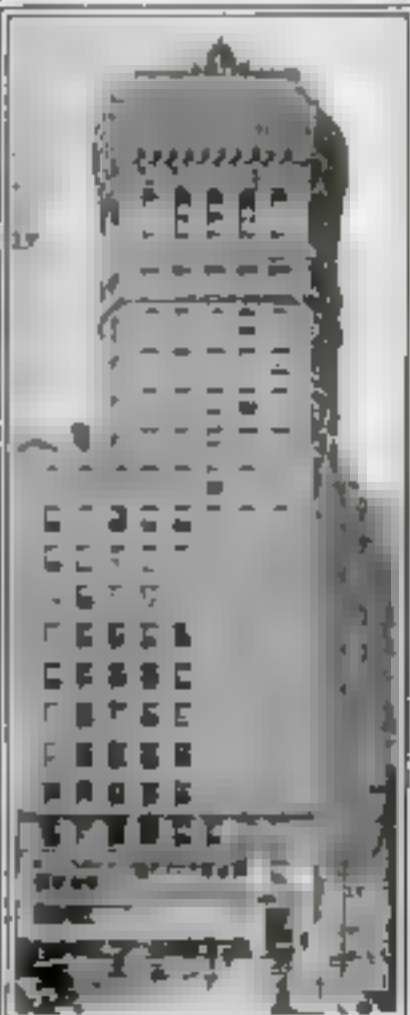
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Can a Bald Man Grow Hair?

(Continued from page 144)

The other day a really shrewd busi-
ness man told me that he could build
a house on what he had spent for "cures
for baldness." He informed me that he is
still ready to spend money to get his hair
back, and I prophesy that he never will
have trouble in finding someone who is
ready to exchange a marvelous hair
restorer for a slice of his income.

Most of the alleged cures for baldness
are constructed on the dandruff theory.
The idea seems to be that the hair sprouts
out of the skin like a bean seedling, that
cakes of dandruff keep this delicate struc-
ture from coming to the surface, and that
the removal of the obstructing layers of
dandruff is all that is necessary to allow
the little hairs to shoot up as luxuriantly
as a lawn after a heavy rainfall.

A recipient of one method of growing
hair once sought to squelch me by point-
ing to a new growth of downy hair on his
scalp. "That's what the treatment did
for me," he said proudly. But six months
later when I asked him if the downy
growth of hair had gained strength, he
had nothing to say. Speech was unneces-
sary, his polished, business dome told the
whole story. The only thing the treat-
ment had grown was money in the seller's
bank account.

Solutions to Tests on Pages 26 and 27

1. Star Test

The method of scoring this test is to add
your time measured in seconds to the
number of errors you made, an error
being made each time your pencil
crosses one of the double lines that
make up the star. The average score
is 47. From 46 to 97 is superior; be-
tween 97 and 193 poor.

2. Concentration Test

The average person detects all errors
in two minutes. If you completed the
test in less time than this your power
of concentration is superior. If you
took more than two minutes you are
lacking in ability to concentrate.

3. Proverb Test

a=11, b=8, c=1, d=8, e=13, f=9,
g=2, h=7, i=10, j=3, k=4, l=12,
m=3. You should have completed
this test in the five minutes allowed.

4. Symbol Test

The average person can place the num-
bers correctly in the symbols in two
minutes. You can measure your adapt-
ability and your power of learning new
things by noting whether you com-
pleted the test in less or greater time
than this.

5. Letter-Number Test

This test can be completed by a person
of average intelligence in 144 seconds.

6. Number-Series Test

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test in not more than three minutes.

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Test Tubes Solve Crimes

(Continued from page 10)

found that one after another of his horses died for no apparent reason. The dealer naturally suspected his competitors who might have a grudge against him, and these simmered down to two; but they never came near his place.

"In desperation the dealer appealed to us, and a close watch was set on the barn. One day the guard noticed a boy about 16 years old hanging around the stable. He answered questions satisfactorily, and, when his pockets were searched, nothing was found in them beside the usual clutter, except an apple cut in two, one half in each lap pocket.

Now, while it is not unusual to find an apple in a boy's pocket, it was queer to find it cut. The apple was sent to us, and we found that it contained yellow phosphorus, one of the deadliest poisons known. Examination showed the same poison in the stomachs of the dead horses. Confronted with this evidence, the boy confessed that one of the fruit dealer's competitors had hired him to feed the horses poisoned apples. It was a clear case, and we got a conviction.

"WE HAD a case not long ago," continued Mr. Kelley, telling of another poison incident of a couple who weren't getting along very well. Suddenly the husband developed a stingy streak. He began to ration his wife, especially on sugar. Each morning before going to work, he would set out a certain amount of sugar for the day, telling her that she had to be content with that ration.

The wife began to feel ill, but the doctor could find nothing seriously wrong. He suspected indigestion. But the woman's suspicions had been aroused, and she set aside her allotments of sugar for a week. She came to court with the little sacks labeled "Monday, Tuesday, Wednesday" and so on. "Is this sugar," she demanded, "or is it something queer?" We found that the week's ration contained enough bichloride of mercury to kill a horse. In the husband's effects a bottle containing the same poison was found, and that was enough to force a confession."

Analysis of all drugs and narcotics seized by the New York police is another of the big jobs of the crime laboratory. Last year alone more than a half-million dollars' worth of drugs was seized in the New York district. These are found in most surprising forms.

Drug addicts use so much craftiness in procuring narcotics that constant vigilance is necessary to see through their trickery. On Welfare Island, where drug addicts are sent when sentenced, for some time it was suspected that they were getting hold of narcotics. No one could figure out how. One by one various possibilities were discarded until only the mail remained.

ONE day, soon after the mail had been given out, an officer noticed one inmate chewing a piece of paper. He watched for the next letter addressed to that prisoner. With the letter was a piece of

(Continued on page 151)

Fast Life Wrecks the Nerves

by PAUL von BOECKMANN

Lecturer and Author of numerous books and treatises on Mental and Physical Energy, Respiration, Psychology and Nerve Culture

WE are living in the age of SPEED, the make-a-minute life. We crowd two or five years of life into one. We hurry; we worry; and we disappate, little realizing that there must come an end to our supply of Nerve Force—that we will become nervous wrecks.

Long before a person reaches the final stages of nervous collapse, he passes through months and even years of sub-normal nerve power, which seriously handicaps him in life, undermines his constitutional powers and causes all kinds of organic and mental disorders. It would be proper to call these people "near-neurasthenics."

There are countless "near-neurasthenics" about us everywhere—in the streets, in the cars, in the theatres, in your business, and especially in your own home—right in your own family.

They are said to be troubled with nerves," a condition which is not considered serious, but admitted to be most annoying, especially to those who must associate with people who have "nerves."

"Nerves" is not a malady which manifests itself, as many people believe, in twitching muscles, trembling hands. These conditions are found only in advanced stages of Nerve Exhaustion.

The symptoms of Nerve Exhaustion vary according to individual characteristics, but the development is usually as follows: First Stage: Lack of energy and endurance; lack of initiative. Second Stage: Nervousness, restlessness, sleeplessness, irritability, loss of sex force, loss of hair, nervous indigestion, sour stomach; gas in bowels; constipation; irregular heart; poor memory, lack of mental endurance; dizziness, headache; backache; neuritis, rheumatism, and other pains. Third Stage: Serious mental disturbances; fear, undue worry; melancholia; dangerous organic disturbances; suicidal tendencies; and in extreme cases, insanity.

If only a few of the symptoms mentioned apply to you, especially those indicating mental turmoil, you may be sure that your nerves are at fault—that you have exhausted your Nerve Force.

Perhaps you have chased from doctor to doctor seeking relief for a "nervousness," something the matter with you. Each doctor says that he will cure the matter with you. But every one is wrong. You know there is something the matter. You feel it all the time. You are tired all day, cannot sleep, cannot digest your food and you have pains here and there. You are told you are "nervous," and a doctor may prescribe a drug—a nerve stimulant or sedative. Leave your nerves alone. It is like making a tired horse run by towing him behind an automobile.

And don't be deceived into believing that some magic system of physical exercises can restore the nerves. I may have seen some but it does so at the expense of the nerves. The hands of athletes have learned through bitter experience.

The cure of weak and deranged nerves must have for its basis an understanding of how the nerves are affected by various causes and factors. It is a clean, scientific, logical, and sane way of dealing with the nerves. It is a clean, scientific, logical, and sane way of dealing with the nerves. It is a clean, scientific, logical, and sane way of dealing with the nerves.

I have made a life study of the mental and physical characteristics of nervous people, having treated more cases of "nerves" during the past 25 years than any other man in the world, over 100,000 cases.



PAUL VON BOECKMANN

Author of *Nerve Force* and various other books on Health, Psychology, Breathing Hygiene and kindred subjects, many of which have been translated into foreign languages.

The result of this vast experience is embodied in a 64 page book entitled "Nerve Force," a book that is essentially intended to teach how to care for the nerves, how to apply simple methods for their restoration. It includes important information on the application of deep breathing as a remedial agent. The cost of the book is only 25 cents, cash or stamps. Address: Dr. Paul von Boeckmann, Studio 162, 110 West 40th St., New York City.

This book will enable you to diagnose your troubles intelligently. The facts presented will prove a revelation to you and the advice will be of incalculable value. Whether you have had trouble with your nerves or not, your nerves are the most precious possession you have. Through them you experience all the pleasures of life, and it is worth living for to be dull, nervous, or dull-brained. Inability to the higher phases of life—love, moral courage, ambition and temperament. The finer your brain is, the finer and more delicate is your nervous system, and the more temperate it is, the longer you live for your nerves.

"Nerve Force" is not an advertisement of any treatment I may have to offer. This is proved by the fact that large corporations have bought and are buying this book from me by the hundreds and thousands for circulation among the employees—Efficiency Physicists recommend the book to their patients—Health Ministers recommend it from the State—Nerve Control, Happiness. Never before has so great a mass of valuable information been presented in so few words. It will enable you to understand your Nerves, your Mind, your Emotions, and your Body. Over a million copies have been sold during the past fifteen years.

What Readers of "Nerve Force" Say:

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A physician says: "Your book is the most sensible and valuable work I have ever read on the prevention of neurasthenia. I am recommending your book to my patients."

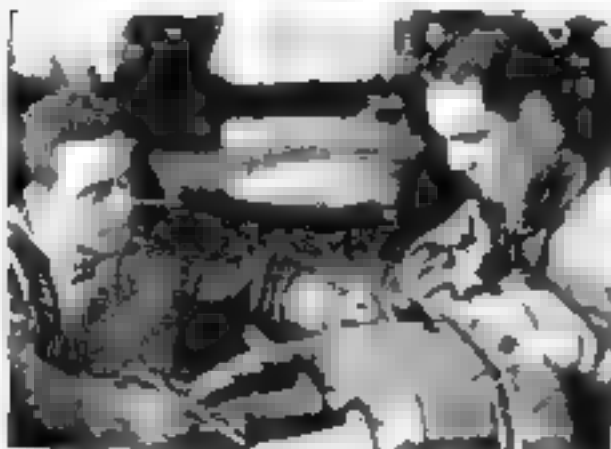
"Reading your book has stopped that dreadful feeling of PEAN which paralyzed my stomach and digestion."

"Your book did more for me for indigestion than two courses in dieting."

My heart is now regular again and my nerves are fine. I thought I had heart trouble but it was simply a case of abused nerves. I have re-read your book at least ten times.

"The advice given in your book on relaxation and calming of nerves has cleared my brain. Before I was half dizzy all the time."

"I have been treated by a number of nerve specialists, and have traveled from country to country in an endeavor to restore my nerves to normal. Your little book has done more for me than all other methods combined."



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Test Tubes Solve Crimes

(Continued from page 147)

plain white blotting paper. This was sent to a chemist for examination. He found that the paper had been saturated with heroin, a white drug. By chewing this, the addict could obtain the drug as readily as if it were in powder form.

A system of cooperation with business and professional men aids the bureau in tracing clues. Unknown dead, for instance, are often identified by sending a chart of their teeth to dentists. The dentists check these with charts of plates they have made and send in the name of any patient who has a plate similar to that of the dead person.

Laundrymen help by giving their private marks used on linen. These have been the doom of many a criminal.

ABOUT a year ago a veteran safelower picked up a 17-year-old boy in Seattle and with him began one of the most remarkable cross country automobile tours of which the police have record. They blew safes in Ogden, Salt Lake City, Denver, Minneapolis, and Cleveland, the boy acting as look-out and driver. Their trail streaked across the northern states.

At Buffalo the safelowering stopped, and one day in Brooklyn, New York, the boy was caught. At first he refused to speak of his partner. But his acute dissatisfaction over the division of the spoils eventually led him to divulge the name of the older man.

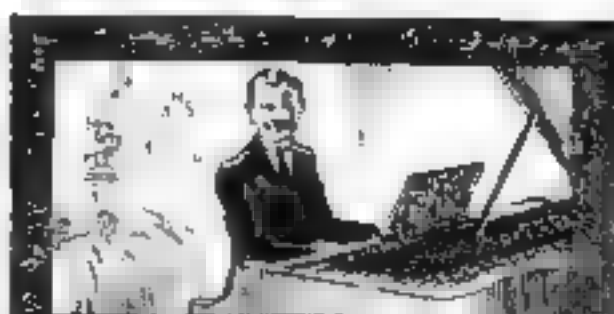
The safelower had skipped town, and even the boy had no idea where he had gone. He seemed to have dropped out of existence. In his room, when he fled, he had left an old discarded shirt. On the neckband was a typical Chinese laundry mark. Checking this on a list, the laundry was located.

The detectives figured that there was a chance in a thousand that the man might have had some linen in the laundry and would return for it. The old Chinaman kept no records of names or addresses but trusted only to his memory. A close watch was set up at the laundry, and several weeks after the boy was caught, the safelower came in for his laundry, and was captured.

ANALYZING liquors and investigating explosives are other tasks of the remarkable criminal laboratory. Taking a bomb to pieces is not the ordinary man's idea of a comfortable job. But with scientific methods even such a dangerous task can be handled safely.

For the moment the bureau is endeavoring to make the police realize the importance of sending in trivial objects found on the scene of the crime. It is hard for the average policeman to realize that a hairpin or broken comb or grease spot, may now become powerful instruments to convict.

Later on, the officials plan to send experts and an emergency kit, with some of the more important instruments, directly to the scene of the crime, along with the photographer and finger print expert. The criminal of the future will have no easy task to plan his perfect crime.



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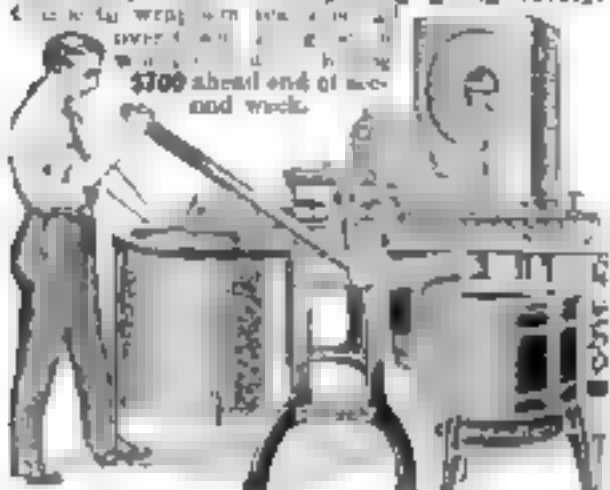
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He Freed Women from Drudgery

(Continued from page 147)

Howe's consciousness. He had ambitions far beyond any he had ever voiced. His work in Davis' shop had taught him that he had talents better than the ordinary for understanding and utilizing mechanical equipment. Some of his fellow workmen surpassed him in skill with tools. None, though, surpassed him in ingenuity. All of this to this wideawake youth suggested a career as an inventor. Yet, just like the young inventors of today, he found a huge obstacle before him, the question, "What shall I invent?"

And, then and there, young Howe knew that this question had been answered for him; that he had taken the first step in surmounting the obstacle. A sewing machine! It met all the requirements of the successful invention. It was useful. It filled a human need. Its application was wide almost infinite.

THE young mechanic found himself strangely exalted. He went to his belongings that night walking on air. The road to fortune had opened up before him.

And then for almost six years Howe did nothing more than think about his invention! It wasn't laziness, lack of courage or anything of that sort. On the contrary, the fact that he continued to think of a sewing machine instead of putting the idea out of his head as impractical is proof conclusive of Howe's courage and steadfastness. The trouble was that the machine failed to assemble itself properly in Howe's mind.

After six years, however, in 1843, Howe's idea received an impetus from two mighty forces—love and necessity. The young mechanic had married, and was the father of three children. Howe's return from his work in Davis' shops failed to keep pace with his added responsibilities. To complicate matters further, instead of being merely physically frail, he became actually ill. There were times when he could not work at all, and his young wife, in an endeavor to make up the deficit in the family budget, began to sew for the neighbors.

It was torture to one of Howe's self-reliant and sensitive spirit to watch his bride become hollow-eyed and stoop-shouldered from long days and nights spent plying her needle. For all his brooding over the idea of a sewing machine, never had he realized the crying necessity for the invention until it was thus brought home to him. He determined to wait no longer for the detailed plans of the machine to form themselves in his mind, and began the construction of a machine by the "cut and try" method—experiment. His first efforts—and they lasted for a year—were flat failures.

HE persevered with his efforts, building machine after machine. Each one, though, failed to sew. And then suddenly it occurred to him that all along he had been on the wrong track. What he required was not an automaton that would imitate more or less faithfully the move-

(Continued on page 149)

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He Freed Women from Drudgery

(Continued from page 149)

ments of a woman in sewing, but a machine that would accomplish the same results in its own way. A lock-stitch—thread fed from both above and below the cloth simultaneously and joining together, instead of a single strand moving in and out—an eye placed not at the blunt end but just above the point of the needle—here was the solution!

The idea seized him with such overwhelming force that almost before he knew it he had quit his job with Davis to devote his whole time to the development of his machine. His friends and his neighbors expostulated with him, some abusively calling him a fool and a shirker thus to cast aside the duty he owed his family to pursue a wife and the wife.

His wife with noble courage redoubled her efforts to earn for the family and bade her husband proceed with his invention. His father, with equal faith in his ultimate success, offered him and his family a home on his farm. Before the end of 1844, Howe had completed a model machine.

AT THIS juncture, with his goal virtually in sight, Howe was forced to quit work on his invention through lack of funds. Desperate, he at last demonstrated his model to George Fisher, a local dealer of Spencer. The latter was impressed favorably, and offered \$500 to Howe for materials and tools in return for a half share in the invention if it proved patentable. Howe agreed, and by April, 1845, had produced a machine that sewed smoothly and evenly.

After sewing a suit of clothes for Fisher and one for himself, Howe invited several Boston tailors to inspect his machine. They declined, so he took his model to the Quincy Hall Clothing Factory and for two weeks demonstrated it to all who visited the place. But human nature sprang from distrust of anything new held people off. Boston remained indifferent, unfriendly even, both to the invention and its inventor. Howe gritted his teeth and set to work building a second model for the Patent Office in Washington.

During the nine years he had been dreaming about and working on his invention, it had seemed to Howe that with the patent papers in his hand his long struggle would be over. On the contrary, though discouragements worse than any he had experienced before arose to confront him. He exhibited his machine at a fair, but no one would either buy it or rent it. Fisher, who had financed Howe to the extent of \$2,000, began to complain. Wherever he showed his machine it met either indifference or ridicule. Slowly but certainly poverty, ill-health and his failure to arouse public interest in his invention began to undermine Howe's morale.

HE SENT his brother to London, and the latter succeeded in selling one of Howe's machines to a corset manufacturer named William Thomas for 250 pounds. Then Howe himself went to England with his family and for a paltry

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Getting Ahead?

Read the advertisements on Pages 128F to 158 this issue if you want to get ahead!

He Freed Women from Drudgery

(Continued from page 150)

weekly wage spent eight months in building a special corset machine for Thomas. When the manufacturer sought to persuade Howe to remain with him on the same terms to "execute miscellaneous repairs," the inventor declined, sent his family back to America, and began the construction of another machine.

When this was finished, Howe had not a cent. He sold the machine for five pounds, taking a promissory note in payment. This he discounted and sailed for home, landing in New York with 60 cents in his pocket. Within a few months of his arrival his wife died of tuberculosis, and Howe, sadly bruised in spirit, sought work as a journeyman machinist.

Broken in health by overwork, worry, and the privations incidental to poverty, Howe had every reason to believe that fate had marked him for a failure. His days were filled with exhausting work, his nights with bitter memories.

AND then one day came to him the astounding tidings that the sewing machine he had invented was proving a great success! It was a success, though, in which he was not sharing, for others had seized on his invention during his absence in London and were reaping a harvest.

It was a situation that would have daunted any man. And yet, penniless and sick, with his original model and his patent pledged for debt in London, Howe determined to fight. His backer, Fisher, seeking to save what he could from what seemed an impossible wreck, sold his half-interest in the invention to George Bliss. The latter yielded to Howe's importunities and agreed to advance money to attack the infringers of the sewing machine patent.

Through court after court the suit dragged. Howe, ill most of the time, lived from hand to mouth while his meager earnings went to defray the costs of this seemingly endless—and hopeless—litigation. And then in 1851—seventeen years after the idea of a sewing machine had first taken root in Howe's mind—Judge Sprague, of Massachusetts, decided that Howe's patent was valid and that all subsequent manufacturers of sewing machines would have to pay tribute to him.

THIS momentous decision came just in the nick of time for the man whose unconquerable devotion to his life's work in spite of poverty, sickness and neglect, probably is not matched in the annals of inventive science. Howe's patent had only one more year to run. But so extensive had the manufacture of sewing machines become that money began to flow into the pockets of the hitherto impoverished inventor in a flood that bewildered him. Up to the time that his extended patent expired in 1867, Howe's royalties, it is estimated, amounted to not less than \$2,000,000, a staggering sum in that period.

In that same year Howe died. He lived but a few years to enjoy his victory,—long enough, though, to see the results of his life's work recognized and rewarded.

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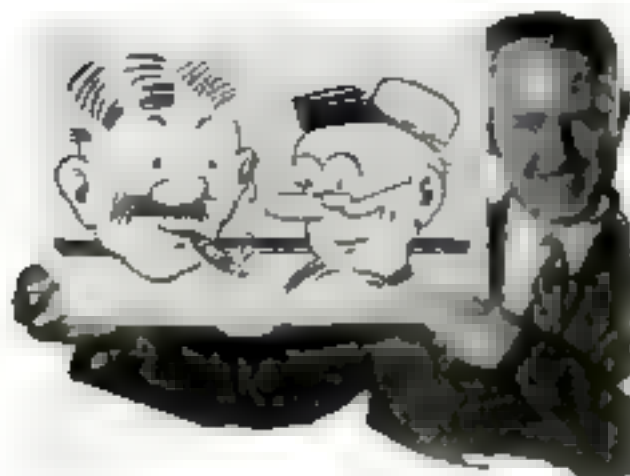
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Do Athletes Die Young?

(Continued from page 35)

people. Of course, there have been early deaths among the runners and jumpers and weight throwers. Lon Meyers, who in the early 'eighties won national championships at every distance from 100 yards to a half-mile, died at the age of 41. Martin Sheridan, New York policeman and Olympic Games winner in 1904, 1906, and 1908, died at the age of 37. But Arthur Duffy, who, in 1902, was the first man to run 100 yards in 9½ seconds, time that never has been beaten, and Maxie Long, whose record of 47 seconds for 440 yards on a straightaway course, made a quarter of a century ago, still stands, are alive and well. So are Alfred Shrubbs, the English distance star of twenty-odd years ago, and Hannes Kolehmainen the original "Flying Finn."

Added evidence that track and field athletics do not shorten life is that every one of the ten men who were members of the University of California track team that competed in the East in 1890 is alive today.

Tennis has lost Robert D. Wrenn but there is no proof that strenuous tennis tends to shorten life. Every one of the men on the English and American Davis Cup teams of 1900 was alive in 1925. Dwight F. Davis, now secretary of war, was one of the holders of the national doubles championship in 1906 and 1909. Norman E. Brookes, the world famous Australian "old master" plays a dangerous game at the age of 47.

KNOWING when to let down, and when to quit, helps athletes to keep out of the early-death class. Eugene J. Gannon, an oarsman, and coach of the New York Athletic Club crew, died in 1923 at the age of 37. Mr. Gannon refused to acknowledge the marching years, and his death was the result of his heart's failure to stand up under the strain of running a brisk mile on the track.

Rowing is the most strenuous of all sports. It has been determined by Yandell Henderson and Howard W. Haggard professors of applied physiology at Sheffield Scientific School, Yale University, that each oarsman in an eight-oar shell pulls 15,015 foot-pounds a minute in a race—which means that each minute he does work equal to climbing the stairs of an eight-story building.

William H. Geer, director of physical education at Harvard University, made a study of the records of 139 oarsmen who rowed on Harvard crews between 1852 and 1900. He found that in 1900 there was a record of 57 deaths. According to the American Experience Tables of Mortality the number of expected deaths for the group was 92. Only 69 per cent of the normal number of deaths for the group had occurred, and other calculations showed that the average life expectancy of the oarsmen was 4.27 years above normal.

Desiring to obtain the opinion of an accepted authority on the question "Do athletes die young?" I went to see Dr. William C. Anderson, director of the Yale University gymnasium.

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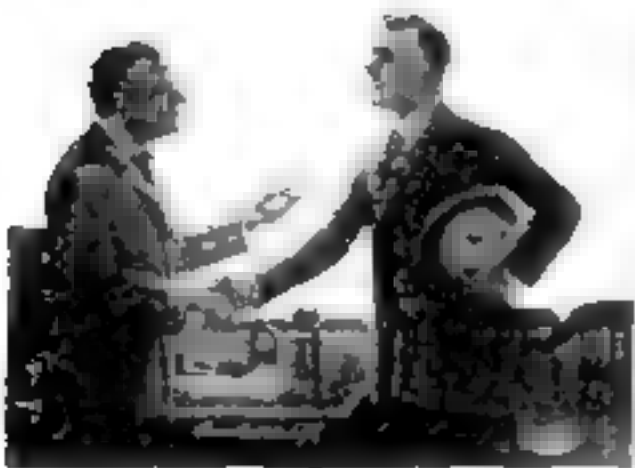
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Here Are Correct Answers to Questions on Page 52

1. No. Careful scientific records show no change at least within the last century or two. Some winters are severe others are less so.

2. Because the tongue has its nerves much nearer the surface and much more exposed than are the nerves in the skin.

3. So that you can get some idea of distance. When you look at anything, the eyes have to point in slightly different directions so that both shall see the object. If the object is close, the eyes must converge. Your brain perceives, unconsciously, the amount of this convergence. This gives you some idea of how far away the object is.

4. The growth of trees is marked by annual rings in the trunk, and the width of the rings tells us something about the rainfall—the more rain, the wider the ring of growth. Some of the Big Trees of California are 3000 years old. Their growth rings show that at the time of Christ the climate was moister than today.

5. Ancestors of the ostrich have lived for millions of years in countries where ability to run fast was more important than ability to fly. Accordingly, the wings have become useless.

6. No. The rear axle never is turned toward us. The moon's axis tips at times and discloses a little more than one hemisphere.

7. A kind of oxygen. The molecules of ordinary oxygen contain two atoms of oxygen each. Ozone, on the other hand, contains three atoms of oxygen.

8. The metal of the spoon absorbs heat. This cools the first part of the liquid so that the glass is not heated quite so suddenly.

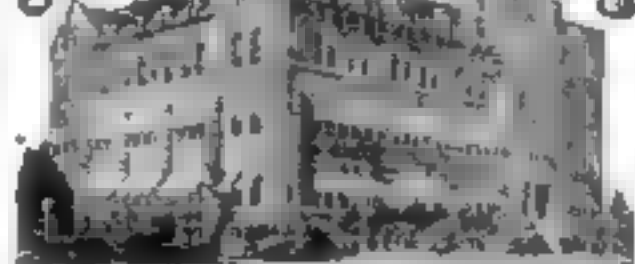
9. The conditions that caused the Great American Desert are typical. Rain in the western part of the United States comes mainly from the Pacific Ocean. Close to the ocean is a range of mountains. Farther east is a still higher range. These two ranges cause the moist winds from the Pacific to rise high above the earth. This cools the winds. Most of the moisture then is condensed and falls as rain on the seaward slope of the mountains. Very little water is left in them to provide rain for the land farther east, so this land is desert.

10. No animal corresponding to the sea serpent is known. The many reports of sea serpents may be due to people seeing a school of porpoises following each other.

11. Because it keeps the air away. Without oxygen rust cannot form.

12. To set the muscles in motion and thus increase the flow of blood.

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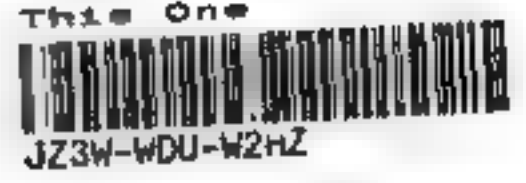
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RCA-Radiotron

MADE BY THE MAKERS OF RADIOLAS

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"I can tell that taste
in the dark"

CHESTERFIELD

LIBERTY & MYERS TOBACCO CO.

**When it's a perfect winter day—
and you've just returned from a
tramp in the crisp country air
—when you come in and
find the crackling fire
awaiting you
—have a Camel!**



Into the making of this one cigarette goes all of the ability of the world's largest organization of expert tobacco men. Nothing is too good for Camels. The choicest Turkish and domestic tobacco. The most skilful blenders. The most scientific package. No other cigarette made is like Camels. No better cigarette can be made. Camels are the overwhelming choice of experienced smokers.

WHEN it's late winter afternoon. And you've just returned with your dogs from a ramble over the hills. When you come inside to your friendly fire—have a Camel!

For no other smoke-friend brings back so much cheer and comfort to your fireside as Camel. No other cigarette in the world is welcomed in so many homes. Camels are so skilfully blended that they never tire the taste, or leave a cigaretty after-taste. There's not another cigarette made, regardless of price, that contains choicer tobacco than those rolled into Camels.

So, on this day, as you start your favorite stroll along the sun-lit hills. As you return and come in to the welcome of your sparkling fire, joyfully know the mellowest fragrance that ever came from a cigarette.

Have a Camel!



Our highest wish, if you do not yet know and enjoy Camel quality, is that you may try them. We invite you to compare Camels with any cigarette made at any price.
R. J. Reynolds Tobacco Company